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The advent of severe winter weather throughout the whole northern portion of the United States, and reports of difficulties in railway operation on most lines in this territory, suggest the enormous increase in the cost of operation, due not only to increased coal consumption, but the larger loss attending slow operation and decreased volume of traffic hauled. At such times train operation becomes a matter of getting passenger trains through to destination on any schedule, and freight traffic is limited to a few short trains which run at very slow speeds. In clear, cold weather, when there is no snow obstruction, some return can be made to normal operation, but the train resistance is increased and average speed materially reduced, due partly to wind resistance and to increased journal friction caused by the change in viscosity of lubricating oil. As coal consumption by the locomotive is nearly proportional to train resistance, the fuel expense in winter months in freight service is nearly 50 per cent. greater than in summer months. The resistance in accelerating trains to schedule speed is so much greater in winter that the time occupied is much longer, all of which contributes to the larger winter fuel bill. It is under conditions similar to these where expenses are proportionally large, that there is more opportunity for improvement, and if the extra fuel consumption resulting from frequent stops in winter were fully appreciated by the engineers and trainmen, there would be many changes made in present methods of operation. The increased resistance, caused by journal friction in cold weather when the lubricant is more viscous, is well understood, but as far as we know the subject has not been made one of special investigation in dynamometer work. The extensive measurements conducted by the Engineering Department of the University of Illinois with its remodeled dynamometer car, which is described elsewhere in this issue, will afford good opportunity for a study of train resistance as affected by temperature, and it is the purpose of those in charge to make a thorough investigation of this important subject.

The industrial history of the last hundred years has been plentifully sprinkled with instances of valuable inventions, making great savings or improvements, and hailed by everybody with enthusiasm, which, almost before people could get acquainted with them were superseded and thrown aside because of the advent of some other invention which was still better. This common experience is brought to mind by the letter, printed in another column, of W. L. Park, general superintendent of the Union Pacific. Mr. Park tells a most interesting story of how he has improved his discipline so that the trainmen regularly obey even the flagging rules, the most troublesome rules in the whole code; and then, almost in the same breath, he goes on to inform us that he has got beyond the need of flagging. His automatic block signals give such satisfactory service that he has actually told his flagmen to take advantage of the protection afforded by them. No one east of the Missouri has ever dared to say this out loud. True, Mr. Park does not declare himself quite so unqualifiedly as we have put it in this paraphrase, but our statement gives substantially the correct impression, we are quite sure. And this experiment of the Harriman lines (which was first brought to public notice by Mr. Slater at the Washington meeting of the Signal Association two years ago) should prove valuable to superintendents all over the country. Not the least interesting statement is that declaring that good discipline is a tangible asset, when a road is dealing with passengers. Another point is that good discipline in the matter of flagging brings improved behavior in other matters. This was to be expected, as has been predicted repeatedly in these columns.

But while the officers of the Union Pacific are to be commended for their progressive ideas and for what they have accomplished, it must be observed that they have not cured the incurable defects of the flagging rule. They still retain the loosest screw in the whole mechanism. The brakeman is to flag when the "circumstances" require it. He is to use fusees "if conditions warrant"; if recalled before he has gone far he is to put down torpedoes, "if necessary," and he is told to go farther than the distance named in the rule, "if conditions require it," though he is not told how much farther. What good is done by putting down torpedoes at, say, 40 rods from the standing train? All these conditional precepts go to show that the U. P., like all other roads, recognizes that the flagging rule must be elastic, and everybody knows that with an elastic rule the matter always remains unsettled. We have in every day practice the alternative of omitting the flagging at times when any intelligible *rule* would forbid its omission, or else of incurring unnecessary and intolerable delays to trains. In other words, the present instructions cannot be called rules; they are too indefinite. With such indefiniteness the situation would be unsatisfactory even if

all our brakemen were as good as the best ones; but they are not all first class. The really and permanently important thing in the Union Pacific practice, therefore, is the high degree of perfection that has been attained in the operation of the automatic block signals. With the space interval maintained in the greatest practicable efficiency we shall by and by abolish flagging, as has been done in Great Britain. And this satisfactory degree of efficiency is not so far in the dim future as it formerly seemed to be. The Union Pacific is doing good work toward hastening the day of consistency and simplicity; and one or two other roads are beginning to help in the good work.

In granting permission to the Erie to issue $30,000,000 30-year 5 per cent. collateral trust bonds, the New York Public Service Commission, Second District, has stipulated precisely what use shall be made of the proceeds of the bonds. Notes issued in March, 1908, to meet desperately pressing needs, and notes now being issued to provide for the refunding of interest coupons on the company's general lien and convertible 4 per cent. bonds, are to be retired by exchanging $10,500,000 new bonds at par for the notes at par. Bonds to the amount of $11,380,000 may be issued to be exchanged for coupons of the convertible 4s falling due before August 1, 1909, and the remaining $8,120,000 bonds may be issued and sold at not less than 87½. The Commission makes its approval to dispose of any of the bonds conditional on the actual expenditure on improvements and additions by the company of an amount equal to the face value of the coupons refunded. The road, in asking permission to refund its coupons, argues that at present its net receipts just about pay fixed charges, but that if it may use these receipts for making improvements and additions, instead of paying the money out as interest, it will later be able not only to earn its fixed charges and interest on the money now borrowed, but some profit as well. The Commission, in effect, takes the company at its word. It says: "Go ahead, but see that the money that would have been paid out in interest is actually spent on the property." The success of the company's plan now depends on two closely related conditions. In the first place, 90 per cent. of the bondholders must be willing to exchange their current interest coupons, as they come due, for new bonds at par, and J. P. Morgan & Co. must be willing to, in effect, accept new bonds at par for the cash that they have been paying out to meet the interest falling due on certain issues of bonds during the past 10 months. The second condition is that the Erie shall earn sufficient to enable it to spend the required amount on additions and improvements. The willingness of the bondholders and of J. P. Morgan & Co. to meet the first condition is directly dependent on their belief in the ability of the Erie to fulfill the second condition. As a step in the regulation of railways, this exact definition of the uses to which the proceeds of a bond sale must be put carries this case to the boundaries of government control.

FREIGHT-TRAIN MILEAGE AND FREIGHT REVENUES.

The accompanying drawing shows the relation between freight-train mileage and freight earnings, on a large trunk line for almost eight years. A similar drawing showing passenger-train mileage and passenger earnings on the same road for the same period was published in our issue of November 13, page 1328. The figures on the left hand margin of the drawing refer both to the number of freight-train miles and to the number of dollars of earnings from freight traffic.

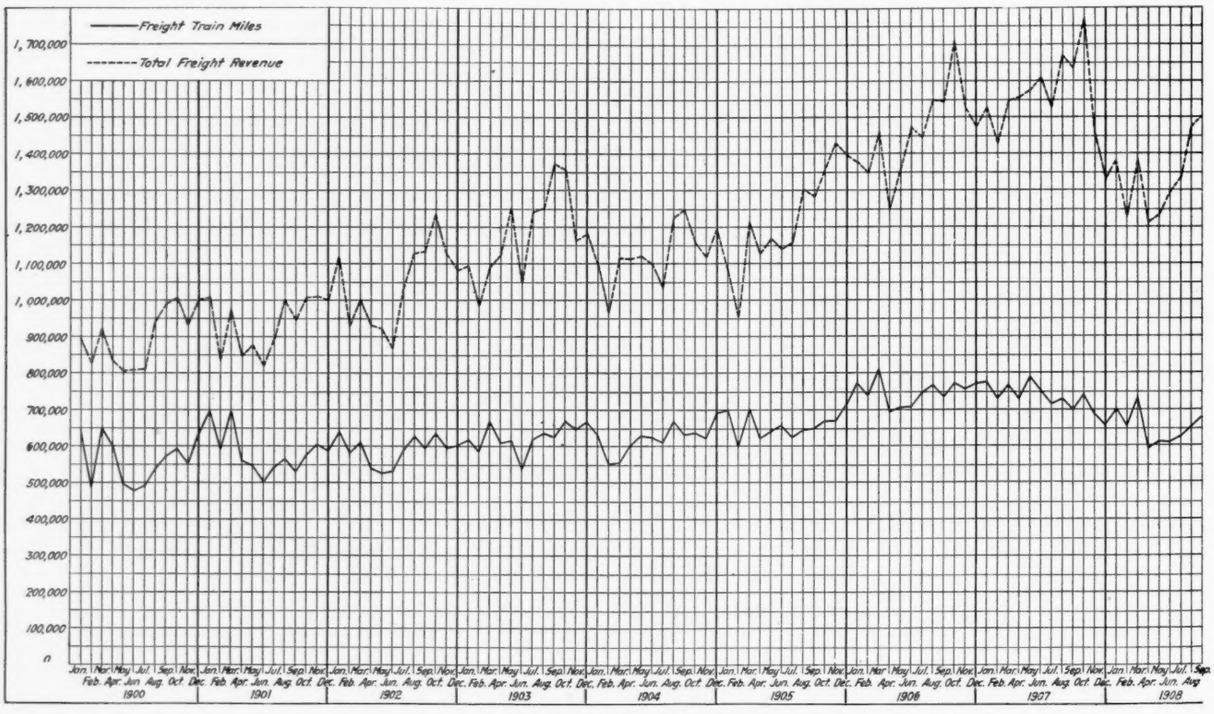


Diagram to Illustrate Comparison Between Freight Train Miles and Freight Train Revenue; Years by Months, 1900-1908.

On comparison of the drawing in our issue of November 13 with the one presented here, a very striking contrast will be noted. In the former drawing the train-mileage and earnings lines frequently crossed and recrossed. In summer the passenger earnings line rose much faster and in winter declined much faster than the passenger-train mileage line. Occasionally earnings increased while train-mileage decreased. Sometimes earnings decreased while train-mileage increased. But in the drawing presented herewith the freight-train mileage line is always below the earnings line and always goes up and down with it. If, when passenger business falls off in winter, railways also reduce the number of passenger trains, there arises an outcry against them from the public and from

railway commissions. On the contrary, when freight business falls off in April, May and June, train service may be and is reduced correspondingly, and reaches its maximum when traffic is lighest, which usually is in June. When traffic picks up in September and October freight-train service is increased, and reaches its maximum when there is the most freight moving, which may be at any time from September to January.

The result is an essential difference between the results from freight and passenger business. While the cost of handling a ton of freight one mile varies with the volume of business, it does not vary anywhere near as much as the cost of hauling a passenger one mile varies with the volume of business. Plainly, it costs about as much to haul a passenger train with a very few people in it as to haul it well-loaded. In proportion, therefore, as the number of passengers per train increases the cost per passenger declines, and in proportion as the number of passengers per train decreases the cost per passenger increases. We know of one case where one of the fastest through passenger trains in this country hauled but three passengers from its point of origin to its point of destination. We know of another case where another fast through train hauled but a half-dozen passengers. Obviously, the cost of hauling each of these passengers per mile was very great, and exceeded by many times the revenue derived from them. Such a thing could not happen in the freight business, because most freight trains, unlike all passenger trains, are not run on fixed schedules, but are run only when there is business for them to handle. When a road has 500 cars of freight to haul from Chicago to New York it hauls them in ten trains. When it has only 300 cars of freight to haul it hauls them in six trains. Within limits, therefore, it can throughout the year adjust its freight-train mileage and the resulting expenses to the traffic offered and the probable earnings from it.

When there was so much complaint two years ago about shortage of cars we heard shippers say that freight ought to be handled as passengers were—that if freight trains were run regularly and on fixed schedules there would be enough facilities to hanule the business and shippers and consignees would not be subjected to frequent losses because of delays to goods in transit. Study of the facts shows that if all freight was handled on regular, scheduled trains, the freight business would become as unprofitable as the passenger business is in the West unless there was a very heavy increase in freight rates. On the road to whose business the drawings we have printed relate the average rate per ton per mile in 1900 was 5.58 mills and in 1908 was 5.73 mills. Meantime, the estimated average cost per freight-train mile rose from $1.24 to $1.67. But for an increase, meantime, in the average tons per train mile from 291 to 387, by the use of more powerful locomotives, longer trains, larger cars and better loading of cars, the profits of the road from freight business would have been wiped out; the revenue per ton mile in 1908, if no more tons had been hauled per train mile than in 1900, would have been considerably less than the expenses per train mile. The advance in the average number of tons per train mile, however, increased average earnings per train mile from $1.50 in 1900 to $2.07 in 1908. There could have been no such increase in tons per train mile if regular, scheduled freight service had been required.

The conclusions to be drawn from these studies of passenger and freight-train mileage and earnings are obvious. A regular, fast, scheduled service, maintained throughout the year, such as the passenger service given by American railways, is bound to be very expensive, because it is adjusted, not to the average amount of business available throughout the year, but to the maximum amount of business available at any part of the year. In proportion as a service approaches the irregularity of the extra, large tonnage, freight trains that are put on as business increases and taken off as it decreases, it approximates to the minimum possible cost of operation. If the public prefers the cheapest practicable service, either passenger or freight, to a regular, frequent service, it can get it by letting the roads adjust train mileage at all times to the traffic available. But if the public prefers a regular, frequent service, either passenger or freight, in the long run it will have to pay for it in higher rates. Railways, like other commercial concerns, must cut the coat according to the cloth; and in the long run either the public will have to pay for the kind of service it gets, or the railways will have to give it the kind of service, passenger or freight, for which it pays.

THE UNIT IN RAILWAY OPERATION.

We need in railway operation to-day a wider knowledge of the essential nature of units. The accountant and statistician have latterly been hard pressed by a querulous public and a fastidious investor for definite measures of situations that shall take the place of indefinitely formed impressions. The Statistical Committee of the American Railway Association has specifically stated its problem as a problem of devising units.

The railways run to make money. Between the outgo of the investor's money for plant and expenses, and the intake of revenue, is a vast complex of causes and effects. These may have all degrees of significance to the final result sought, and they may range through almost every form of activity and of relation to individuals and to the social order in its various groupings. There is grave danger where the result is so far removed from the cause, that is, where the return desired is so far removed from the outlay which was designed to produce it, that the mind should be lost in the maze, and that there should result a vast aggregate of purposeless expenditure of time and resources. To preserve this chain of sequences and trace throughout the efficient cause to its adequate result where so many causes are contributing to a result, and so many results other than the one sought flow from a particular cause, it is absolutely necessary to have units. These units gather the effects at each stage of sequence to serve in turn as the causes to the next stage of sequence.

A unit is that thing which throughout its entirety responds in the same way to the same causes and produces in the same way the same effects. The idea is again expressed in the word entity. In the more common use of the word, a unit is some definite part of an entity which bears all its characteristics—or, in other words, it is the entity in miniature, and serves as a basis for measuring the significance of the entity.

But while the notion of what a unit is may be clear, in practice we can only most rudely approximate it. What we do adopt as a unit, is, in statistics, but one of the several coincident results. So long as the proportionate relation between it and the other coincident results is not disturbed, it serves as an index for all of them; but when some new factor is introduced this relation may be so disarranged that the particular result which we have used for an index of the whole body of results ceases to be reliable. Over and over again are mistakes made by ignoring this principle. Operating officers have been educated to the use of certain more or less accidental units. The increasing pressure is for "results." Reputations are made and blasted in terms of these units or "results," while real causes and effects are lost sight of. We do not go far back in railway practice to find the fetich of the operating ratio, and, somewhat more recently, of the big train load. Only when all the unrecorded causes and effects continue to have the same proportionate relation to the cause and effect which we use as the index to the whole, is our index significant. A big trainload that is accomplished at the cost of expensive locomotive maintenance, demoralized train movement, increased loss and damage expense, less ton-mile net efficiency of equipment, extraordinary costs for revision of bridges and structures and maintenance of track, disturbed morals of the trainmen—is not a gain, but distinctly a loss. Year after year these losses can go on without any

registry being made, except in the underlying conditions. They are only offset by the enormous productivity of the railway in other directions which makes up for the colossal blunders of its managers.

A first principle which the statistican recognizes is that a large part of his results are what he calls deferred results, and he throws the expense offsetting them into the class called maintenance. In this way he is able to apportion such causes against their effects for a series of years. A railway is in business for not a day, a week, or even a year, and more and more does it turn its attention to tracing the effects of these causes whose productivity is deferred or distributed over many years. Only in the light of such knowledge are intelligent policies devised; in other words the problem is to discover those larger entities or units within which cause and effect must be brought together to arrive at an intelligent notion of the net result. The official income account of a month or a quarter of a year is at best but a very partial index to the situation. Underneath is the play of the corroding or enhancing factors which at last in some way will come to the surface and be registered in the income account when it shall be too late.

If it is necessary that the statistician recognize these principles in his compilations it is far more essential that the manager recognize them in forming his organization. The problem of organization on a railway is a problem, at the last, of classification. The contending schools of divisional and departmental organization are in finality dealing with a statistical problem. We believe that a closer analysis of the real things that are happening along with the "results" that are produced is needed. Among these real things to be taken into view, and which so far have too often been ignored by railway men, are those far reaching causes and effects that are working out in the personal temperament and efficiency of the men. Railroading to-day, even within the lines of the operating forces themselves, and quite apart from the public questions raised, is a science of sociology, not less, but even more than it is a science of mechanical, and civil and electrical engineering. Lines of organization are frequently drawn across the grain of human nature in absolute disregard of the normal, healthful social forces that can be drafted into the service of the road and made to register their effects in the income account.

Incidental to the doing of anything the manager should remember that there is a by-product which is the maintenance and betterment of the intelligence and interest and moral qualities of the man who does the work. This is not upon any sentimental grounds, but from the strict requirements of the situation—to make more money. Mr. Rockefeller has said that his great company has built up its wealth from its by-products. Mismanaged railways have lost great aggregates of wealth by ignoring the by-products to be worked out in the constantly enhanced efficiency of their working force. Few realize the potentialities in an aggregate of 25,000, 50,000 or 100,000 men set into natural unit groups within and through which should be the free and selectivity play of all the latent forces in an orderly completion making for the enhancement of the net income of the road. In this eager race for "results," railroading is reduced to a mere arithmetic of superficial and frequently transient or local phases of the great underplay of the profoundly philosophical causes and effects. When to this is added the taint of personal favoritism or the obnoxious features of class consciousness, the situation has become hopeless indeed. There is a need in railroading for that large comprehension that unites the present with the future, the immediate cause with the remote effect through all the slow intricacies of educational, social and moral agencies. The great railway edifice at last rests upon the man. No complexity of machinery nor ostentation of aggregates can displace the requirement of self-respecting, eager, individual efficiency.

Letters to the Editor.

TIGHTENING THE GRASP OF GOVERNMENT.

New Haven, Conn., January 11, 1909.

To the Editor of the Railroad Age Gazette:

Most persons had supposed that when Mr. Bryan with his platform demanding rate making by the Government, physical valuation of the railways and federal control of railway capitalization, was so overwhelmingly defeated last November we should enjoy a period of comparative rest from agitation for further experimental legislation against the railways. It will be recalled that the proposed plank demanding a physical valuation of railway property by the federal government which came before the Republican national convention was defeated in the committee on resolutions. Nevertheless now and then I read in some daily paper an interview or public utterance, usually inspired from Washington, telling of a proposed measure to be passed by Congress for federal control of railway capitalization.

If such a measure is to be considered by our Congress it seems only fair to ask, since we still profess to be a government by the people, whether there is a really popular demand for it. Are our people generally, or any large and interested class among them, demanding this legislation? If they are they seem to be singularly quiet about it. Does the shipper ask for it? I have endeavored to follow this question in its various aspects as closely as possible, and yet I fail to learn from any source of any large or representative shipper or class of shippers demanding this sort of legislation. In fact, the intelligent shipper seems to know that railway rates in this country bear no relation to the capitalization of the railways; that although he may suffer at times from discriminating or unreasonable rates these irregularities cannot be charged to overcapitalization. The remedy must be sought elsewhere.

Does the merchant want it? I fail to hear of any association of merchants expressing itself as favoring this proposition. On the contrary, the New York Merchants' Association—

". . . respectfully urges all members of Congress . . . and of railway commissions to encourage the return of railway business to normal conditions by ceasing and discountenancing ill-considered or unjustified censure of existing methods of railway management, and by limiting proposed new legislation on these matters to such measures as have been so carefully investigated and studied as to determine clearly not only the necessity for their enactment, but also their proper form and scope for the accomplishment of intended reforms."

Does the investor want it? Perhaps in this whole discussion there is nothing more significant than the silence of the investor. Of all persons in the community there is none whose interests would be more directly and seriously injured than the investor's from overcapitalization. The thoughtful investor knows that governments are proverbially prodigal and extravagant in their expenditures of public and other funds. Will it be less extravagant in its supervision of the expenditure of railway funds and of the output of railway securities when the government has no responsibility in the securing or raising of such funds? This present scheme of administrative supervision divorces the relations between the stockholder and his directors. It diminishes the self-reliance and watchfulness of the former and destroys the sense of moral responsibility of the latter. The stockholder is the natural foe of overcapitalization, but he is the last to ask that his prerogatives as owner should be taken away from him.

Do we hear of any lawyers advocating or approving of this new step in the system of our government? No. He who is learned in the law knows that the proposed legislation is a somewhat violent stretch of the United States Constitution and of the sphere of action of the federal government. Nor has any student of railway economics favored this idea.

Who does want it? I will enumerate to the best of my information: Professor Henry C. Adams, statistician to the

Interstate Commerce Commission; the members of that commission, a few of the more radical members of Congress and some politicians and loquacious agitators. That is the extent of the list at present. In a really popular form of government "what are they among so many," while hundreds of thousands, nay, millions of merchants, shippers, business men and investors either express themselves as opposed to the scheme of legislation or are ominously silent so far as any request is heard. Those who support it are all in public life or have their own political fortunes and aspirations to guard.

Whether the American railways are overcapitalized or not, the proposed remedy for the alleged evil is of a radical and experimental nature and open to many economic, constitutional and practical objections. Furthermore, it is submitted that the burden of proof lies upon the proponents to show that this legislation is necessary and expedient and that there are actual and existing evils which the new scheme will in its natural consequences remedy and correct.

It would seem only proper that those who so flippantly assert that our railways are overcapitalized first define overcapitalization and then prove their assertion. It would be very interesting if the Interstate Commerce Commission would explain to us, if this sort of government interference is necessary, why the American railways, after three-quarters of a century under the present system of corporate management and freedom from governmental control, are the most lightly capitalized of any railways in the world, save those of Denmark, Norway, Sweden and South Australia, while the American shipper enjoys the lowest freight rates of any shipper in the world.

ARTHUR C. GRAVES.

Contributed Papers.

MANUAL BLOCK SIGNALING WITH THE "A B C" SYSTEM ON NORTHERN PACIFIC.

The essential features of the block signaling rules put into use by Superintendent Beamer on 63 miles of the Northern Pacific single track about a year ago, and on over 500 miles in October last, are well known to readers of the *Railroad Age Gazette.*† The train despatcher controls all trains without a time-table, and the block signalmen in the stations, using a separate wire, distinct from the despatcher's train wire, go through the regular operations of the telegraph block system, so as to confirm the safety of the despatcher's movements independently of his actions. Permissive movements are strictly forbidden, except in rare emergencies.* The freight train capacity of the road has been increased on some divisions about 20 per cent., and in some of the comparisons even a higher percentage is shown. And while the average speed of freight trains has been thus improved there has at the same time been a saving in wages to the company per train mile; and by spending less time on the road each trip the men can make more trips per month. That there has been an increase in safety, as compared with the ordinary time-table and despatcher system, goes without saying, almost. On this last point evidence is scarcely necessary, for the superior simplicity of the space interval system is apparent from a mere statement of the two methods.

In view of the reported success of Mr. Beamer's innovation we have inquired of him somewhat particularly concerning the experience which he has thus far gained, with a view to giving an account, more detailed than has heretofore been published, of the reasons for and against adopting the "A B C" rules on railways generally. (By a "free" interpretation we may assume that "A B C" means Alfred Beamer, creator.)

The first and most significant fact to be taken into account is that Mr. Beamer at the outset, desiring to secure safety first and celerity second, determined to run his trains regularly by absolute blocking only. Having done this he was prepared to adopt regulations which for simplicity much resemble the train staff system; and the train staff system (or the tablet, based on the same fundamental principles) is generally agreed to be the safest method yet devised for spacing trains on single-track. The superintendent who is always ready to relax well known and desirable safety measures for the sake of saving a little time for a train, may as well at once give up the idea of completely repeating the success obtained on the Northern Pacific. One who expects to do much permissive blocking must expect not only to have a lesser degree of safety, but to sacrifice much of the simplicity which is an important element of strength in any scheme for regulating train movements.

Before entering upon a comparison between the Beamer plan and the better known methods of train control, we will notice a few details of the Northern Pacific practice.

DETAILS OF OPERATION, SPOKANE AND TROUT CREEK.

The record shown herewith, Fig. 1, is that of an eastbound freight train of December 1st, 1908, running from Spokane to Trout Creek, 133 miles. The number at the top, D F 187 is the regular designation of this manifest train each day, and the same number is retained from the Pacific Coast starting point through to St. Paul, Minn. The notations in the eight lines at the heading are self-explanatory. Littlemore was the engineer of engine 472, a helper running from T. C. (Tuscor) to J. (Trout Creek). Engine 2418 is the regular engine of the train.

†See *Railroad Age Gazette*, November 6, 1908, page 1286; September 4, 875. See also *Railway Age* for 1907, as follows: February 22, page 237; April 12, page 595; May 3, page 698; May 17, page 765; November 15, page 672; also March, 1908, page 303.

*Following are the principal features of the order issued when the system was introduced on the division east of Spokane.

Effective at 12.01 a.m., October 10, all time-card trains [both passenger and freight] shown on Time-table No. 29, are annulled. All the running rights that a train has at any time are conferred upon it through the medium of a block card, issued by the train despatcher.

A block is the section of main line extending from the signal at one telegraph office to the signal at the next telegraph office in advance.

Train and enginemen are prohibited from accepting or running on a card purporting to authorize them to pass an open telegraph office.

No train will, except under flag protection, be allowed to leave a terminal or pass a telegraph office, no matter what may be the position of the signal semaphore, without both the conductor and engineer first securing a block card authorizing the train to use the block in advance.

Immediately following the departure of a train from a telegraph office the operator will report its departure to the despatcher and to the operator at the next telegraph office in advance of the train.

Immediately upon receipt of this report the operator at the office in advance will assure himself whether the block in advance from his office is clear, and if so, he will at once ask the despatcher, in the form provided, for the block in advance for the approaching train. If his record shows the block in advance is occupied by another train, he will hold his signal against the approaching train until advised that the block in advance is clear.

Having secured the block card from the despatcher he will at once secure from the operator at the next office in advance a pledge of the block for the train for which the despatcher has authorized the block card. After this has been accomplished he will place his signal in the clear position and deliver a copy of the card to the engineer and another to the conductor as the train passes his office.

Trains approaching telegraph offices and finding signal at clear will understand from this that the block ahead is clear and will pass the telegraph office without reducing speed, catching the block cards as they pass. If, however, from any cause the cards should not be secured the train will be brought to an immediate stop and will not proceed until the cards are secured.

Conductors and engineers will immediately examine the block card following its receipt by them and make sure that it is correctly made out. They will follow implicitly all instructions given them thereon. If directed to take siding at a station they will do so *disregarding a signal to come down the main line.* The rights conferred on the train by a block card cannot be *extended* by a signal, but may be *restricted* by one.

When taking siding to meet an opposing train or to be passed by a following train, trains will head in at the first switch at all points where lap sidings are provided.

All exceptions, and the name of the telegraph office in advance, must be repeated to the despatcher by the receiving operator. [A card bearing no exceptions is not repeated.]

When necessary to change instructions on cards that have already been put out by the despatcher, he will invariably do so by annulling the card containing the instructions which it is desired to change. . . . Despatchers will, when making a change in meeting or passing points, invariably use the term, "Instead of."

All trains will be designated by the number of the engine pulling them.

In the event of a wire failure occurring between two telegraph offices, trains will simply flag across. When trouble of that kind occurs despatchers on the side of the break opposite from the despatcher in whose territory the break occurs will be advised of the fact by the operator closest to the break, . . . and will move trains over the detached territory until repairs to the wire have been made.—For other details of this circular see *Railroad Age Gazette*, November 6, 1908, page 1286.

The space for No. (number) at the top of the card is used in filing the records at the close of the day.

(The "train sheet," which is before the despatcher at any given time consists of as many of these long, narrow strips as there are trains on the road at that time. Each strip is kept between brass grooves or slides, and as soon as a train has completed its trip the strip is taken out.)

The heading of the card being thus filled in, the remainder of the record is made from the bottom upward; the cards for this division being always printed so that westbound trains are to be read downward and eastbound trains upward.

"Time Ordered" is the time at which the train crew was ordered to be on hand. In this case the train left promptly at the expected hour. Despatcher Darling had charge of this movement from the starting point to Hauser; Despatcher Wyckoff from Hauser to Noxon, and Despatcher Smith from Noxon to the end of the division.

The train started with 41 cars, weighing 1591 tons. The first block card was No. A-188, delivered to the train at Spokane. The number of this card is entered against the next block station, Yardley, at the time the card is issued, and, of course, *before* the arriving time at Yardley has been entered. By this practice the despatcher always has a clear indication of the cards which have been issued and have not been fulfilled.

Card A-196 was issued at Trent for the movement to Hauser, with an "exception" informing this train that it was to take the siding at Otis (not a block station) and there meet westbound engine No. 1617.

Card A-202 was issued at Hauser for the movement to Rathdrum. The stop of 18 minutes at Rathdrum is noted at the bottom, as having been required to take water ("RD. wtr.").

The first note at the bottom, "Otis No. 53 (1617)" shows the train which was met at Otis, No. 53 being the designation of its character as a fast freight.

The next note indicates that there was a loss of ten minutes between Trent and Otis, because of low steam.

Returning now to the time record, we find that at Ramsey order No. A-214 was given for the movement from Ramsey to Athol, with an exception to "Take siding and meet engine 292 at Athol." The note at the bottom of the record, "AX No. 15 and set out," means that the train met at Athol was passenger No. 15, and that there was also at that station a delay to set out one or more cars.

Card A-236, issued at Athol for the movement thence to Granite, had the exception "Take siding and let engine 161 pass at Granite."

The 34 minutes' delay at Granite needs no explanation, as this train had to clear the block section in the rear before the passenger train (engine 161) running in the same direction, entered it, and then had to wait at Granite until the passenger had cleared the block section in advance.

Card A-249, issued at Granite for the movement from Granite to Cocolalla, contained the exception "Look out for engines 1371 and 1365, working on main line."

Card No. 280, issued at Kootenai for the movement to Hope, contained the exception "Take siding at Hope." This was not to meet any particular train, but to allow the crew a period of time, the length of which was not known, to eat and to coal and water the engine.

This card was issued at Kootenai to run to Hope, because the office at Oden was not open at that time, 8:05 p.m.; but by the time the train reached Oden the operator had come on duty and reported the train. Oden is open at night but not in the day time.

The notation 39-0-1590 means that from Hope the train consisted of 39 loaded cars, and no empty cars; weight, 1,590 tons.

The despatcher not being informed as to how long a time would be used at Hope, the next order would not be issued until the operator at that station, being informed by the conductor at the proper time, called for a card for the movement from Hope to Clarks Fork. It may be assumed that in this case he asked for the card at, say, 9:35. The departing time in every case indicates the actual departure of the train from the station, and not the time when the conductor gave the signal to start.

The notation at the bottom of the sheet, "H. eat and fill," means not that the trainmen were to eat and be filled, but that they were to eat their luncheon at Hope, and fill out the train with cars (some having been left at Athol).

The notation "H R No. 3 (233) and no steam," means that at Heron passenger train No. 3 was met, and that there was a delay also, because of low steam pressure. Passenger trains

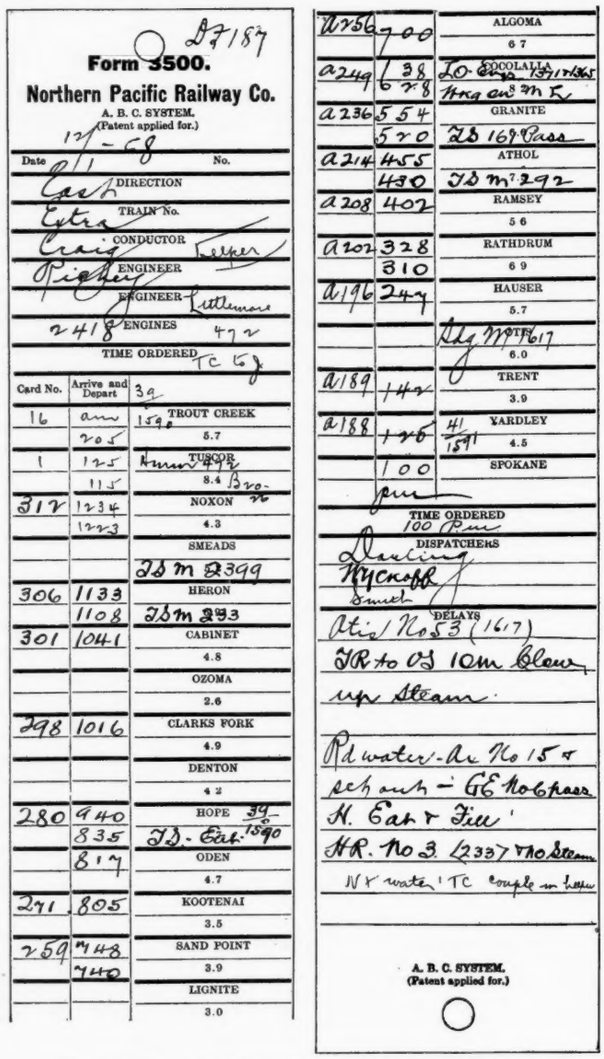


Fig. 1—Sample of a Despatcher's Train Sheet.

Actual length of sheet, 18 ins. Sheet cut in two and engraving reduced about one-third in height and width.

continue to be called by their numbers which have been in use for years, although these numbers have nothing to do with the running rights. They are of use mainly for the passenger department and for advertising.

The order issued at Noxon is No. 1, being the first number issued after midnight. This order bore the exception, "Hold main track and meet engine 472 at Tuscor." There was also another exception on this card consisting of instructions to run at a certain restricted speed over two places between Noxon and Tuscor, these notations being the substance of bulletins No. 20 and No. 26. This is the meaning of the notation on the record "B-20-26."

The last notation at the top of the card, "39-0-1590," shows

the make-up of the train when it arrived at Trout Creek.

The last notation at the bottom of the card means that the delay at Noxon (Nx) was for taking water, and that the helping engine was taken on at Tuscor.

One day's trains.—The chart, Fig. 2, shows graphically the movement of all the trains over this district for December 2, 1908; four eastbound and four westbound passenger trains through; one passenger train each way between Spokane and Hauser Junction, and 20 through freight trains, 10 eastbound and 10 westbound. From Spokane to Yardley, 4½ miles, and

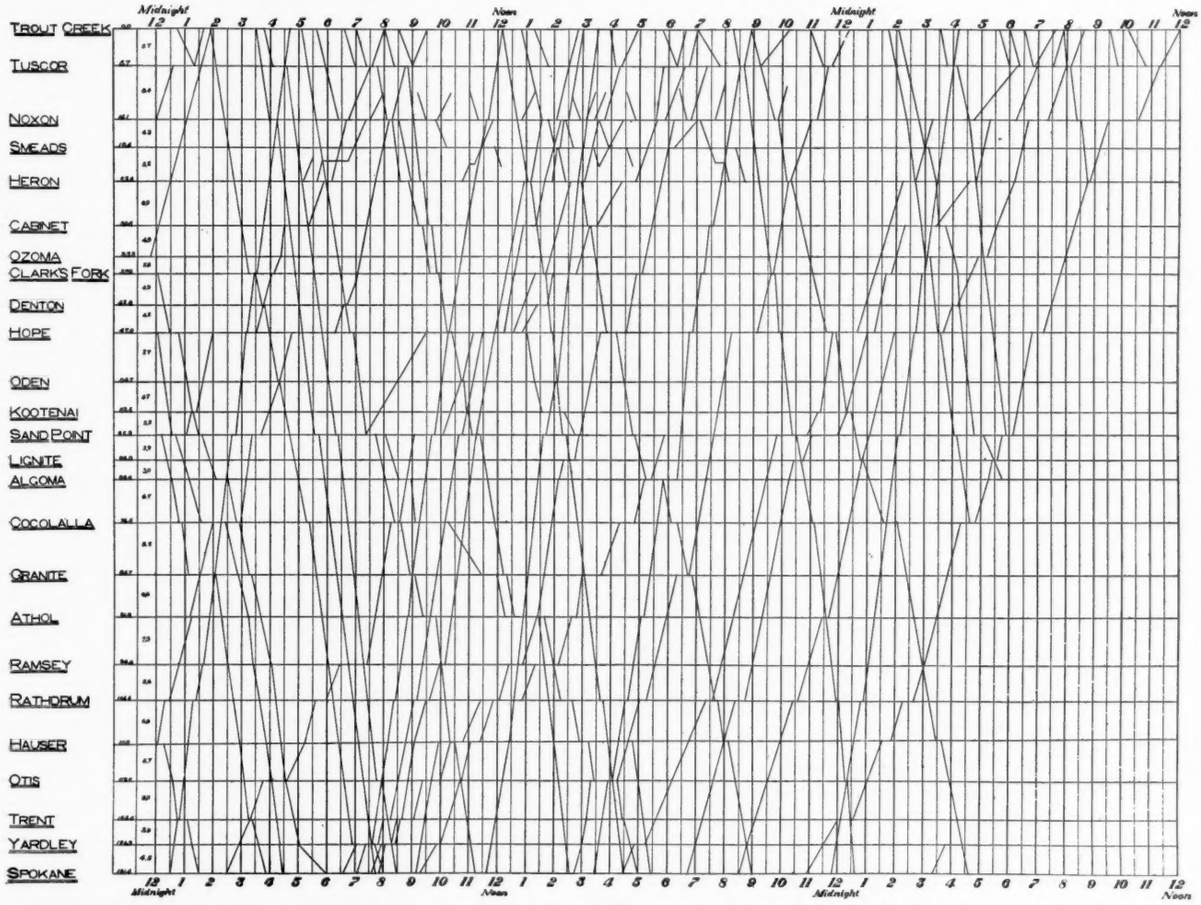


Fig. 2—Movements of Trains Between Spokane and Trout Creek, December 2, 1908.—Northern Pacific.

The passenger trains, eastbound, are those leaving Spokane at 12:30 *a. m.*, 7:09 *a. m.*, 11:37 *a. m.*, 3:28 *p. m.*, 11:52 *p. m.; westbound, leaving Trout Creek at* 3:30 *a. m.*, 3:50 *a. m.*, 12:10 *p. m.*, 8:17 *p. m.*

for a short distance between Rathdrum and Ramsey there are two main tracks, which accounts for the meetings of trains between stations. The short runs between Heron and Smeads and between Noxon and Tuscor represent gravel trains. The meeting of trains at 10.45 a.m. between Cocolalla and Granite was at a "blind" spur track. When trains meet at a place like this, the block cards given to the conductor and engineman confer right to the meeting point, and there the conductors secure new cards by telephone. All of the "blind" sidings are equipped with telephones.

The meet at Kootenai at 1:15 a.m. was arranged the same as for a blind siding, Kootenai being closed at night.

The station track diagrams, Fig. 3, are samples of diagrams, one for each station, with which the despatcher's desk is equipped. The engravings are one-third the actual size.

In the table below, the tonnage and time of freight trains over this line for the first 15 days in November, 1908, are given, together with the average time of all of the freight trains of each day; and alongside of these figures are shown those for the corresponding days of 1907. The weather conditions were the same in 1908 as in 1907. At the earlier date the manual block system was in use, with standard code despatching rules, but permissive blocking was freely used; while at the later date there was no permissive signaling. As will be seen by the summary at the bottom, the average running time was reduced 9⅔ per cent., though the number of trains run was 20 per cent. greater. Besides this increase in trains, the operation of the division was complicated in 1908 by the presence of four work trains each day, traversing a territory of 20 miles between Heron and Trout Creek, making usually four trips a day, or 16 trips for the four trains. The number of through passenger trains is four each way daily, and, in addition to these, there is one passenger train each way daily between Spokane and Hauser.

Comparison of A B C and Standard Code Operation between Spokane and Trout Creek. Through Freight Trains Only.

	1907				1908			
Date.	No. of trains.	Tons.	Time, Total, hrs. m.	Time, Ave. h. m.	No. of trains.	Tons.	Time, Total, hrs. m.	Time, Ave. h. m.
Nov. 1..	12	14,690	133 11	11 06	17	19,746	152 13	8 58
" 2..	17	19,635	181 47	10 40	20	22,275	181 09	9 03
" 3..	10	13,699	110 03	11 00	20	21,544	196 40	9 50
" 4..	13	14,498	123 56	9 32	21	22,415	194 09	9 05
" 5..	12	13,672	111 37	9 18	22	24,493	229 54	10 27
" 6..	10	11,802	113 50	11 23	15	18,544	153 49	10 15
" 7..	18	22,851	206 28	11 28	17	19,362	164.10	9.39
" 8..	13	14,673	145 12	11 10	13	17,394	120 52	9 18
" 9..	16	17,981	193 20	12 05	22	27,786	235 58	10 43
" 10..	15	18,957	158 23	10 35	20	24,194	204 06	10 15
" 11..	17	17,525	177 30	10 12	20	20,461	186 10	9 19
" 12..	20	21,711	255 12	12 15	15	17,593	145 22	9 41
" 13..	14	14,182	161 27	11 32	14	18,166	143 20	10 14
" 14..	20	24,652	194 14	9 42	17	22,638	181 00	10 38
" 15..	18	20,243	181 00	10 00	17	18,921	165 55	9 45
	225	260,741	2447 10		270	315,532	2654 44	

Average running time, 1907, 10 hrs. 52 min.
Average running time, 1908, 9 hrs. 49 min.
Saving per train over 1907, 1 hr. 3 min.
Increased efficiency over 1907, 9.66 per cent.
Total trains run, 1907, 225; 1908, 270; increase over 1907, 20 per ct.

A similar statement for the 11 days, October 21-31, being the first 11 days of the operation of the new system, shows

that the time of the trains was reduced 15.5 per cent., while the number of trains run was increased 23.7 per cent. The saving averaged two hours and four minutes to each train. In this October record the tonnage was slightly less than in the previous October, but the whole of the falling off was in the westbound movement.

NOTES.

As with any absolute block system with long block sections, an important element of success is the efficiency of yard operation. A yardmaster whose habits are such that he sends trains out just as the cars happen to be ready, or sends them in bunches, can do much to defeat the smooth working of the block system. On the division of the Northern Pacific here under consideration, through freight trains are started out about once in two hours, making the ordinary capacity of the line 12 freight trains in 24 hours (there are four passenger trains each way). The yardmasters make their calculations to send out trains according to these regular intervals and they do not find it difficult to do so. With a line of this character —with passing tracks about six miles apart and with freight trains making an average speed of 20 miles an hour between stations—this number of freight trains, 12 a day, is, in Mr. Beamer's opinion, the reasonable capacity of the line.

The station operators or signalmen are held to the habit of strict attention to duty by a rule forbidding the despatcher to offer a block card; that is, he must not authorize a train to proceed from B to C until B, having heard from A of the approach of the train calls for the authorization. The man at B must therefore be always on hand to get his advice from A and ask for the authorization in due season so as not to delay any train.

On the other hand, the signalman must not arrange a movement and *then* ask the despatcher to confirm it; for occasionally the despatcher, with his more complete knowledge, finds it necessary to require the station signalmen to hold the train, and cards are never issued long before they are needed.

Specimen block cards are shown in Fig. 4. The space on the cards indicated by the word "exceptions" is used to write in any instructions which may be necessary, as, for example, in card A 214.

These instructions may consist of a direction to meet an opposing train at an intermediate siding which is not a block station; or to be passed there by another train moving in the same direction, or to pass another train headed in the same direction. Where a train has a card to a blind siding, the conductor on arriving goes to the telephone booth and secures a new card for the run to the next station. In giving these meeting and passing instructions, the despatcher is not required to use precisely the same wording to both trains, the repetition of the operations by the signalman being deemed a sufficient safeguard against the chance that an error by a despatcher will go uncorrected. If a card were delivered to engine 2,858 written 2,838 the engineman would see the error and refuse to run on the authority of the card. Enginemen careless in this respect can be tested by decoy cards. If a card said meet engine 48 at the next station, and the engine found there should prove to be No. 49, the conductor and engineman holding the card would go to the station office for an explanation.

Block cards are given to both the conductor and the engineman because it is a duty of the conductor to identify opposing trains at meeting points. On the Northern Pacific the conductors of passenger trains are required to signal to the engineman on approaching a station where another train is to be met.

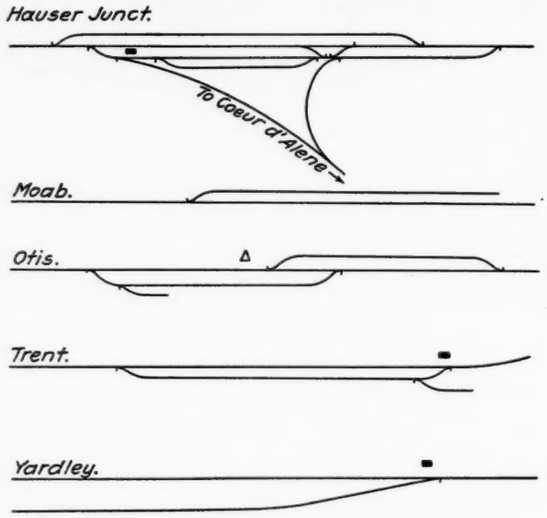


Fig. 3—Despatchers' Station Track Diagrams.

On passenger trains the rear brakeman catches the block cards from the station men and immediately carries them to the conductor.

Enginemen and conductors (or brakemen) catch cards by hand, light rattan hoops being used by the station man to make it easy for the card to be grasped; but experiments are being made with a simple device, to be attached to engines and cars, by which cards can be taken up at any speed without the intervention of the trainman in the operation.

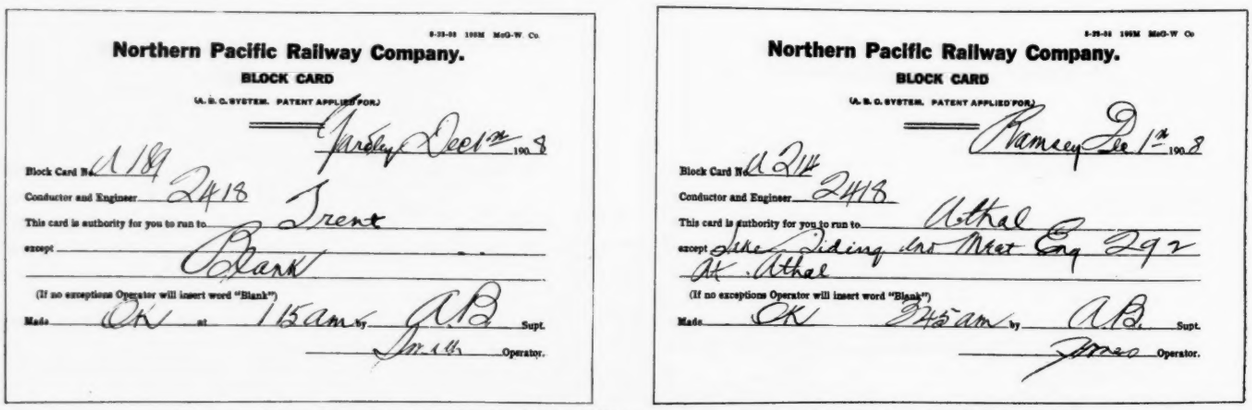


Fig. 4—Samples of Block Cards Used With A B C Despatching Rules, Northern Pacific.
Actual size of cards 5¼ in. x 7⅞ in.

An inspection of the 18 block cards which were given to the conductor of a certain freight train on December 13 shows that for legibility 16 of them would be classed as practically perfect. They would be so classed even by one unacquainted with the road; while the other two are reasonably legible and are, no doubt, entirely satisfactory to men acquainted with the local conditions. Cards are called in and inspected at the superintendent's office often enough to enable the officers to keep informed as to the quality of the signalmen's work.

The operators were carefully instructed before the new

method was put in use, but it is the uniform testimony of the men who did the instructing and of the operators themselves that the new system is so much simpler than the old that the instruction consists mainly in telling what old practices are to be discontinued. Under the new system the work of the operators is so greatly simplified that it is immeasurably easier for an inspector to detect carelessness. Everything that an operator does in connection with the movement of a train is shown on a single slip. In case of any slight irregularity the despatcher is able at once to put his finger on the man responsible.

Of the 55 telegraphers in this district 15 have been in service over two years; six have served two years; seven have served one year; seven six months, and 20 less than six months. All of these men had had experience as telegraphers on other railways before coming to the Northern Pacific.

Provision is made for closing offices temporarily and making two block sections into one. For example, the office at Oden is regularly open from 7 a. m. to 6 p. m., but in the night the block section extends through from Hope to Sand Point.

Surprise testing of course is practicable with this as with any system. A card conveying an impossible order can, with proper precautions, be used at any time to test the vigilance of an engineman or a conductor. The station men can be tested by removing the markers from cabooses and in other ways.

In case of an obstruction of the track which lasts for several hours, the system automatically holds all trains in the block section where they may happen to be; this because of the rigid prohibition of permissive blocking. This gives the greatest possible freedom to the men in charge of the work of clearing the track, and this freedom is interfered with only on the order of the superintendent. Where a blockade lasts long enough to make it necessary or desirable to bunch trains, the despatcher gives all of the orders. The former custom of giving supervisory authority to the senior conductor on the ground has been done away with. In one case six freight trains, aggregating 194 cars, met at a station where there were two passing tracks of 3,000 ft. each. The despatcher gave the order for each movement and the greatest delay to any of the six trains was 20 minutes.

When the telegraph fails between two stations, say B and C, the first train detained by the failure must flag through the block, from B to C or from C to B, as the case may be; but having secured protection at both ends of the block the conductor of that train can then act as a pilot for any or all trains.



Alfred Beamer.

Alfred Beamer, Superintendent of the Idaho division of the Northern Pacific, and the originator of the "A B C" rules, was born at Hillsdale, Mich., in 1856, and began his railway service as a telegraph operator on the Detroit & Milwaukee in 1872. He served as operator, agent and despatcher on that and the Lake Shore, and began his service on the Northern Pacific in 1884 as operator. After a few months, he was made Chief Clerk of the mechanical department at Sprague, Wash., where he remained four years. In June, 1888, he was appointed a Chief Clerk in the operating department; and in February, 1903, he was made Superintendent.

(To be continued.)

FREIGHT CLAIM DELAYS REDUCED.

From the Frisco-Man.

Under a new plan just adopted on the St. Louis & San Francisco the freight claim agent will discontinue addressing superintendents, agents and others direct, with regard to the investigation of loss and damage freight claims, and will send all such claims to the superintendent of transportation for investigation, a bureau for the handling of claims having been provided in that department. Ten traveling agents have been employed, one on each operating division, to whom claims are to be sent for investigation. Some claims will be addressed to agents direct, but comparatively few. The superintendent will not be asked to secure the information. "Over and short" reports will be made, even though goods over may be plainly marked. This report will be sent to the superintendent of transportation with a copy to the traveling agent assigned to the division. He will make an immediate investigation from the "short" report and "over" report, and in case of a "short" report the same as if a claim had been filed. The property will be found or it will be ascertained that it cannot be and the case handled for discipline. It is hoped to have investigation of claims for freight that is lost completed before the average commercial institution presents its claim, thereby enabling the company to make a prompt adjustment.

The office of the superintendent of transportation will have nothing to do with the adjustment of the claims, this being handled by the freight claim agent, as a result of its investigation, and after a recommendation as to the liability of the railway.

The traveling agents will have duties other than the mere investigation of "over" and "short" reports and claims. It will be their duty to see that all agents handle freight properly, keep the proper records regarding the handling of freight, see that the district terminals keep a proper seal record and a proper record for perishable freight, amount of ice in bunkers, the condition of the vent and plugs, and, at certain points which will be specified later, the condition of the freight.

Claims will not be sent to superintendents except where a case is proved against one of their employees, and it then becomes a question of discipline and should be handled by the superintendent personally. It is believed that the number of cases will be decreased to such an extent that it will be no burden to them, but through the handling of these cases personally they will have a knowledge of the freight claim conditions on their division and have an opportunity to remove the cause.

E. D. Levy, superintendent of transportation, says:

For a number of years there has been an incessant demand made by shippers individually, and through their various commercial organizations, for a more prompt payment of claims for loss and damage of freight.

The management of the Frisco railway realizing that there was considerable justice in the complaint of the public with respect to delay in adjusting freight claims, has undertaken to correct it, and the new plan was authorized with this end in view.

In the past practically no investigation was made until the claimant presented his claim. Under the new plan, considering a "short" report and a "damage" report as a claim, and investigating it as such, the investigation being made by an experienced man on the ground, instead of writing numerous letters, it is hoped to have the investigation of the larger portion of our claims for loss and damage completed before the claim is received.

Of course this does not refer to concealed losses, but we can make the investigation of a claim for a concealed loss in less time than under the present practice.

The traveling agents have been impressed with the fact that, while it is important to investigate a claim sent to them

for investigation, and develop all its facts, and to do so quickly, it is secondary to finding the cause of the claim and removing it, in order that we may not have a second one.

Once every month all of the traveling agents will meet in the office of the superintendent of transportation, together with the office force handling the claims, and overs, shorts and damages and all matters will be thoroughly discussed, in order that all may have the benefit of the experience of every individual.

MILITARY HABITS IN TRAIN OPERATION.

BY W. L. PARK,

General Superintendent, Union Pacific Railroad.

The involuntary, as well as the loyal performance of duty, history teaches us, was the aim of the military leaders who have won the great battles of the world. Napoleon was able to drive his adversaries in great numbers and much confusion before him for the reason that his orders were promptly carried out. Grant, at the opening of the civil war, knew the value of discipline when he refused railway transportation and started from Springfield on foot with the Twenty-first Illinois, concluding the march at the front with the best drilled regiment from that state. Lee's strength was in his calm and dignified insistence upon close and faithful observance of his orders. The Japanese in their war with Russia conquered by their superior discipline alone. Without good discipline the skilled strategists would be helpless and the brightest military brain count for naught.

In railway as well as military discipline the first essential must of necessity be a thorough knowledge, by the officials in charge, of what is required. The primary rules governing the operation of trains are comprehensive and plain, and do not contain the intricacies of military tactics; they can therefore the more easily be applied, but such application must be consistent and impartial, and above all, there must be no hesitancy or vacillation at the caprice of some one individual.

The rank and file are constant; they may be looked upon as cast all in about the same mold; and whether the force is formed into an efficient or an indifferent force, depends entirely upon the individual who shapes and carries out the policy of discipline. This individuality of the commanding officer must permeate and dominate the entire organization.

Railroading is more nearly akin to warfare than any other humane profession. The number of casualties to persons on our railways for the year ending June 30, 1907, was 122,855, of which 11,839 represented the number of persons killed and 111,016 the number injured. Of this number the passengers killed were 610, and those injured 13,041. The personal injuries, fatal and non-fatal, assume much the same aspect to the general officers in charge of a railway as to the general officers in command of an army. The responsibility of the railway officer, however, is greater, for he has not the excuse of war. Therefore, if "Eternal vigilance is the price of safety" in battle, it is certainly a maxim that should have first consideration from railway men. It does not, however, and the small things that are so essential to military discipline are usually neglected by railway officials. The patience of the drill sergeant in obtaining an erect bearing, uniform step and prompt obedience to orders all tend to involuntary action in time of emergency, without which "Bull Runs" would appear more frequently in history. But railway officials almost universally neglect these things, depending upon the so-called "esprit de corps" and the native intelligence of the men. But in time of need they frequently find this lacking; or it is weakened by superior allegiance to organizations, or by indifference.

One of the first, but not least important of the steps to good discipline is the proper protection of trains by flagmen. A railway has no right to take in charge passengers unfamiliar with the ordinary means of self protection, and not fully and adequately protect them from the danger of collision. Such protection costs nothing, facilitates the movement of trains and adds much to the general discipline. It can only be obtained, however, by exacting military discipline, which compels involuntary performance of duty at all times and under all circumstances.

There should be no impatience on the part of officials with trivial delays to trains, perhaps originated to discredit this part of the service. Many weeks of patient drilling have been nullified by some official indicating his disapproval of exactness in flagging, with no better reason than personal discomfort at an unusual delay. The men are quick to observe and imitate, and of course are ready to shirk a duty which to them seems unnecessary and unreasonable. A little encouragement to depart from a strict enforcement of this important duty will spread fast, while a reprimand for neglect will travel very slowly indeed.

The flagman cannot render the service with uniformity and zeal unless he understands exactly what is required of him and knows that he is meeting such requirements. Under proper guidance and constant surveillance he will soon take a pride in his work, and render the full measure of efficiency required, not only for safety, but for the reputation of the road by whom he is employed. Here again comes in the "personal equation," not of the flagman, but of the official in charge. If the flagman is spasmodically excused from performing his duty, or the overlooking of a slight departure from the full performance of this duty is indulged in, the discipline is not on a safe foundation; it does not command the respect of the men and the superintendent will not obtain the high degree of efficiency requisite to meet the test of all the circumstances that may arise. Without stability discipline is practically worthless.

Fidelity to duty has seemingly of late years been on the wane among railway men. Many reasons are given; such as, first allegiance to organizations with dependence upon them to obtain mitigation of penalties; the attitude of the public towards railway managements; scarcity of experienced men and fewer apprenticeship opportunities. All of these are perhaps factors, but all can, in a great measure, be counteracted by insistence upon strict observance of the rules.

The "Efficiency Tests" in vogue on the Union Pacific System and the Southern Pacific Company's lines have done much to bring about a more satisfactory condition of discipline. There must, however, be the basis of training in order to obtain the results desired.

Strict observance of flagging rules performed by a bright, neatly uniformed young man, displaying his flag or red light at the same distance from the rear of the observation end of a sleeper, rain or shine, always taking the same attentive position, waiting the same length of time before proceeding farther back, and returning promptly when recalled by the whistle of the locomotive, inspires confidence on the part of the passengers; it adds to their comfort and at the same time contributes to the reputation of the railway.

Constant attention to this duty, and the favorable comments elicited from observing passengers instills pride and loyalty. Passengers ordinarily do not understand the operation of trains; they are quick, however, to appreciate and commend good flagging. Observing efficiency in this respect during the entire day, they are apt to rest well in the assurance that it will be continued throughout the night. Confidence inspired in this way is an asset worth far more than the mere physical exemption from accidents. It brings its rewards in increased patronage and in peace of mind to operating officials. This last alone is worth much more than the cost of establishing and maintaining a right system of flagging.

If railway officials would give this one thing the attention it deserves, they would be surprised to learn to what extent good flagging helps the discipline otherwise. Many of the

duties of the conductor and engineer are dependent upon and made more uniform by faithfulness and regularity in flagging. One of the first essentials to perfection in this respect is the divorcing of the flagman from the engineer and conductor, an innovation frequently resented by both, particularly the latter. The flagman acting independently compels, however, prompt work about the locomotive and baggage car; else he is gone back in the allotted time and must be recalled, a performance relished neither by the engineer nor the conductor.

Where flagging can be dispensed with under conditions of absolute safety, there should be no hesitation in doing so. The fact that innovations of this kind meet much opposition from operating officials indicates a lack of progressiveness in details of operation. The Union Pacific and the Southern Pacific have recently adopted the following rule:

"When a train stops or is delayed under circumstances in which it may be overtaken by another train the flagman must go back immediately with stop signals a sufficient distance to insure full protection. One-fourth of a mile from the rear of the train he will place one torpedo on the rail; continuing back one-half mile from the rear of his train, he will place two torpedoes on the rail, two rail lengths apart. He may then return to the single torpedo where he must remain until relieved by another flagman or is recalled by the whistle of his engine. When recalled, if he does not see or hear an approaching train, the single torpedo will be removed (and not before); if conditions warrant, a red fusee will be displayed to protect his train while returning.

"During foggy or stormy weather, in the vicinity of obscure curves, or descending grades, or if other conditions require it, the flagman will increase the distance.

"Should a train be seen or heard approaching before flagman has reached the required distance, he must, at once, place one torpedo on the rail, and, if by night or during foggy or stormy weather, display a red fusee, continuing in the direction of the approaching train.

"If the flagman is recalled before reaching the required distance he will, if necessary, place two torpedoes on the rail two rail lengths apart by day, and by night display a red fusee in addition, to protect his train while returning.

"When a train is flagged, the engineman must obtain a thorough explanation of the cause, stopping if necessary.

"The front of a train must be protected in the same manner when necessary.

"Conductors are responsible for the full protection of their trains in both directions and under all conditions.

"In block signal districts where the automatic home block signal governing the track in use can be plainly seen at the rear of the train to be at 'stop,' its location being not less than one-half mile from the train to be protected, it will be unnecessary for the flagman to go back. The indication of the signal at the time train passes must not govern the modification of the flagging."

This last paragraph has received careful attention. Before adopting it there was necessary a very thorough drilling of enginemen as to observance of automatic block signals. The drilling has brought this feature of discipline to a very satisfactory stage, fully justifying the adoption of the modified rule. Its merits are that the flagmen are relieved from perfunctorily performing duties that are entirely unnecessary. The responsibility is placed with the engineer of the approaching train and he is so trained that it becomes second nature to move his locomotive under the guidance of the block signals. He involuntarily controls its movements, as directed, and so long as he does so a collision is impossible. Throwing this responsibility where it rightfully belongs sharpens the attention of the engineer. Divided responsibility in this respect, as all railway men are aware, has been the cause of many a deplorable accident, followed by accusations between the men as to each other's shortcomings. Differences are seldom cleared away by later investigations and the question of veracity remains unsolved.

The animate safeguard—the man—has heretofore been deemed more effective than the inanimate object in stopping an oncoming train. Of course in changing from one to the other the step should be carefully taken. The men, however, after thorough drilling and testing on observance of block signals, soon become accustomed to the change; and, once the change is made, we have eliminated the performance of duties that are manifestly obsolete and not in keeping with modern railroading. By dispensing with the human factor as far as possible, and developing a more acute sense of duty and personal responsibility among the employees, American railways may be brought to that high plane of efficiency which all enterprising officers should aspire to and maintain. In this one thing American railways seem to be inferior to the European, and without any good reason. The morale on American railways ought to be better than that in other countries, as we have here a higher average of intelligence and more favorable surroundings, and the young have greater opportunities for advancement. Undoubtedly we lack in efficiency of supervision and education of employees. This, however, is now in a fair way to be corrected, and with the advent of automatic block signaling and interlocking a new era of efficiency is dawning. In the meantime the most essential duty of both officials and employees is to obtain efficient flagging.

ELECTRIFICATION OF MELBOURNE SUBURBAN LINES.*

BY CHARLES H. MERZ, M.INST.C.E.

XIV.

A table herewith gives for each stage the net estimated cost of the rolling stock and electrical equipment thereof, after allowing credit for the steam locomotives and rolling stock displaced, these credits being based on the figures agreed while in Melbourne.

*Cost of New Rolling Stock, Alterations to Existing Stock, and Electrical Equipment.**

	Port Melbourne and St. Kilda branches.	Stages I.	Stages II.	Stages III.
Alterations to existing rolling stock†	£13,175	£69,917	£146,802	£210,726
Additional rolling stock.‡	20,724	20,724	20,724	201,930
Complete electrical equipment	39,028	157,278	293,381	445,038
Total	£72,927	£247,919	£460,907	£857,694
Less credits:				
For locomotives & roll'g st'k released	6,608	28,903	38,615	107,442
Total	£66,319	£219,016	£422,292	£750,252
Spare material	1,355	2,641	3,752	4,629
Total	£67,674	£221,657	£426,044	£754,881

*Including freight, tariff, engineering and contingencies.
†See tables on cost of lengthening and altering suburban steam stock.
‡These figures include the amount to be credited to the country service for the transfer of its cross-compartment stock to the suburban service.

Under the climatic conditions existing in Melbourne it is not necessary to provide sheds for the housing and routine inspection of the whole of the stock. I recommend, however, that inspection pits to accommodate all the motor coaches necessary for Stage I, and three-quarters of the motor coaches necessary for Stage III, be constructed under the Flinders street sidings. I also recommend that an inspection pit to accommodate one motor coach be provided at certain outlying stations.

In addition to this routine inspection, it is necessary to provide for the thorough examination and overhaul of the electrical equipment after each motor coach and trailer coach has run a certain number of miles. For this purpose I recommend the erection of a small car shed on the site available

*Abstract from the Report to the Victorian Railways Commissioners on the application of Electric Traction to the Melbourne Suburban Railway System. Published by the courtesy of the commissioners.

at Flinders street in preference to running the stock into the Newport shops, which would involve an unnecessary increase in the waste mileage. For heavy repairs, painting, etc., the stock would be taken to Newport as at present.

Capital Cost of Inspection Pits and Proposed Flinders Street Car Shed.

	Port Melbourne and St. Kilda branches.	Stages I.	Stages II.	Stages III.
Car shed	£8,795	£8,795	£17,591	£24,251
Inspection pits	5,597	14,743	27,588	33,090
Total	£14,392	£23,538	£45,179	£57,341

The Flinders street car shed will be provided with electrically-operated cranes for lifting the coach bodies, and the necessary stores and tools for dealing with minor repairs and renewal of the electrical equipment.

Annual Cost of Maintaining Rolling Stock and Electrical Equipments.

	Port Melbourne and St. Kilda branches.	Stages I.	Stages II.	Stages III.
Cleaning of cars	£481	£2,638	£5,084	£7,888
Inspection and cleaning of equipm't.	1,053	5,769	11,122	17,256
Sundries—oil and stores	451	2,473	4,766	7,395
Repairs.*	2,707	14,834	28,598	44,372
Total	£4,692	£25,714	£49,570	£76,911

*At Flinders Street car shed and at Newport.

My estimate of the cost of the inspection pits and car sheds proposed is given in an accompanying table.

The cost of maintaining the electrical equipment is almost directly proportional to the mileage run. A table gives my estimate of the annual cost of cleaning and repairs to rolling stock. This estimate is based on my experience with similar equipments.

In order to obtain the motormen's and guards' wages for working the services proposed, rosters have been prepared on the basis of the set-workings referred to, and from these the number of men required to work the service has been estimated. The totals of the wages sheets corresponding to the estimates which have been made for each stage, are given in a table herewith.

Annual Cost of Train-Operating Staff.

	Port Melbourne and St. Kilda branches.	Stages I.	Stages II.	Stages III.
Motormen's wages and stores	£2,693	£10,052	£19,027	£29,079
Guards' wages and stores	2,229	7,728	15,158	23,479
Total	£4,922	£17,780	£34,185	£52,558

I have considered the location of the block sections and, taking into account the extra facilities afforded by a multiple-unit system of electric train operation for handling the additional trains which it is proposed to run, I do not anticipate that for Stage I of the proposed conversion any difficulties need be feared with the sections as now set out. From the detailed particulars of the running speed over each section of the lines covered by Stage I, your signaling department will be able to decide definitely by how much the proposed service can be increased without necessitating a rearrangement of the existing block sections.

The accompanying table compares the time taken by the present steam trains in running over each block section with that which would be taken by the electric trains. The fact that the electric trains occupy the block sections for a shorter time allows of a closer headway, *i.e.*, a more frequent service, and so increases the capacity of the lines.

I have also investigated the effect on the location and number of the block sections in the central area if Stages II and III of the scheme were put into operation, and the above remarks as to Stage I apply to the future stages with the exception of the traffic between Flinders Street and North Melbourne Junction Signal Box. In Stage I the Essendon trains only are concerned, and there is no difficulty. In Stage II the introduction of the Williamstown service results in a two minutes' headway at intervals for two trains, and in Stage III the superimposing of the Coburg and Sunshine trains on the previous services introduces a two minutes' headway at intervals for three trains. While I do not think that the principle of maintaining a regular service over the entire day, independently of the extra trains put on to cope with the rush traffic, should be interfered with, it is possible that your traffic department may be able to lay out the time table to some-

Time of Trains in Block Sections (Stage I).

Down.	Time taken by trains—Steam. M.	S.	Elec. M.	S.
Pt. Melbourne Br.				
Flinders St. to Ferrars St.	4	0	2	16
Ferrars St. to Graham St.	5	0	4	54
Graham St. to Port Melbourne	1	30	0	50
	10	30	8	0
St. Kilda Branch				
Flinders St. to Albert Park	7	0	4	37
Albert Park to St. Kilda	5	30	5	23
	12	30	10	0
Sandringham Br.				
Flinders St. to Box E	2	0	1	46
Box E to Richmond.	1	30	1	12
Richmond to South Yarra	4	0	2	36
So. Yarra to Prahran	3	0	2	24
Prahran to Windsor / Windsor to Balaclava	6	30	1 / 3	36 / 26
Balaclava to Elsternwick	3	0	2	26
Elsternwick to No. Brighton	6	30	5	25
No. Brighton to Middle Brighton	3	0	2	12
Middle Brighton to Brighton Beach	2	30	1	37
Brighton Beach to Sandringham	7	30	5	50
	39	30	30	30
Essendon Br.				
Flinders St. to BoxA / Box A to Viaduct	2	30	0 / 1	42 / 35
Viaduct to No.1 Box	2	0	1	58
No. 1 Box to Franklin St.	1	0	0	41
Franklin St. to No. Melbourne Jctn.	3	0	2	7
N. Melbourne Junctn to Kensington	2	0	1	39
Kensington to Newmarket	3	0	2	56
Newmarket to Ascot Vale	3	30	2	10
Ascot Vale to Moonee Ponds	3	0	2	15
Moonee Ponds to Essendon	3	0	2	42
	23	0	18	45

Up.	Time taken by trains—Steam. M.	S.	Elec. M.	S.
Pt. Melbourne Br.				
Port Melbourne to Graham St.	2	0	0	56
Graham St. to Ferrars St.	5	0	4	51
Ferrars St. to Flinders St.	3	0	2	8
	10	0	7	55
St. Kilda Branch.				
St. Kilda to Albert Park	7	0	5	2
Albert Park to Flinders St.	5	0	4	58
	12	0	10	0
Sendringham Br.				
Sandringham to Brighton Beach	8	0	6	4
Brighton Beach to Mid. Brighton	2	30	1	44
Mid. Brighton to No. Brighton	3	0	2	11
No. Brighton to Elsternwick	6	30	5	33
Elsternwick to Balaclava	3	0	2	8
Balaclava to Windsor	4	0	3	35
Windsor to Prahran / Prahran to South Yarra	5	30	1 / 2	32 / 23
South Yarra to Richmond	3	30	3	9
Richmond to Box E.	1	30	1	6
Box E to Flinders St.	2	0	1	35
	39	30	31	0
Essendon Br.				
Essendon Box to Moonee Ponds	3	30	2	34
Moonee Ponds to Ascot Vale	2	0	1	53
Ascot Vale to Newmarket	3	0	1	33
Newmarket to Kensington	2	30	2	50
Kensington to No. Melbourne Junctn.	2	0	1	32
No. Melbourne Jnctn to Franklin St.	2	30	2	16
Franklin St. to No.1 Box	1	0	0	44
No. 1 Box to Viaduct	3	0	2	19
Viaduct to Box A. / BoxA to Flinders St	2	30	1 / 0	40 / 39
	22	0	18	0

what better advantage and thus improve these conditions; but, if not, additional and automatically operated block sections should be introduced on this section to avoid possible short signal checks to one train affecting the trains following.

(To be continued.)

PAN-AMERICAN RAILWAY.

The German consul at Tapachula, which is very near the extreme southwest corner of Mexico, reports that the rails on the Pan-American Railway were laid to that point, within a few hundred yards of the Guatemala border, July 1 last, and construction trains were then running. The Mexican Pan-American begins on the Tehuantepec Railway at San Geronimo, 20 miles from the Pacific coast, and extends along the foot of the coast range, never very far from the sea, west by south to the Guatemala boundary, a distance of about 260 miles. Shipments to points on this line may be made either from Vera Cruz or Puerto Mexico (formerly Coatzacoalcos), the gulf terminus of the Tehuantepec Railway.

HIGH STEAM-PRESSURES IN LOCOMOTIVE SERVICE.

BY W. F. M. GOSS,
Dean of the College of Engineering, University of Illinois.

II.

II. DIFFICULTIES IN OPERATING UNDER HIGH-PRESSURES.

6. *The work with the experimental locomotive* has shown that those difficulties which in locomotive operation are usually ascribed to bad water increase rapidly as the pressure is increased. The water supply of the Purdue laboratory contains a considerable amount of magnesia and carbonate of lime. When used in boilers carrying low pressure there is no great difficulty in washing out practically all sediment. The boiler of the first experimental locomotive, Schenectady No. 1, which carried but 140 lbs. and was run at a pressure of 130 lbs., after serving in the work of the laboratory for a period of six years, left the testing plant with a boiler which was practically clean. Throughout its period of service this boiler rarely required the attention of a boiler-maker to keep it tight. Water from the same source was ordinarily used in the boiler of Schenectady No. 2, which carried a pressure of 200 lbs. or more. It was early found that this boiler operating under the higher pressure frequently required the attention of a boiler-maker. After having been operated for no more than 30,000 miles, cracks developed in the side-sheets, making it impossible to keep the boiler tight, and new side-sheets were applied. In operating under pressures as high as 240 lbs. the temperature of the water delivered by the injector was so high that scale was deposited in the check-valve, in the delivery-pipe, and in the delivery-tube of the injector. Under this pressure, with the water normal to the laboratory, the injectors often failed after they had been in action for a period of two hours. The interruptions of tests through failure of the injector, and through the starting of leaks at stay-bolts, as the tests proceeded, became so annoying that, as a last resort, a new source of water supply was found in the return tank of the university heating plant. This gave practically distilled water, and its use greatly assisted in running the tests at 240 lbs. pressure.

Probably some of the difficulties experienced in operating under very high steam pressures were due to the experimental character of the plant, and would not appear after practice had become committed to the use of such pressures by a gradual process of approach, but the results are clear in their indication that the problem of boiler maintenance, especially in bad water districts, will become more complicated as pressures are further increased. Since, taking the country over, there are few localities where locomotives can be furnished with pure water, the conclusion stated should be accepted as rather far-reaching in its effect.

The tests developed no serious difficulties in the lubrication of valves and pistons under pressures as high as 240 lbs., though this could not be done with the grade of oil previously employed.

With increase of pressure, any incidental leakage, either of the boiler or from cylinders, becomes more serious in its effect upon performance. In advancing the work of the laboratory, every effort was made to prevent loss from such causes, and tests were frequently thrown out and repeated because of the development of leaks of steam around piston and valve rods, or of water from the boiler. Notwithstanding the care taken, it was impossible under the higher pressures to prevent all leakage, and the best that can be said for the data under these conditions is that they represent results which are as free as practicable from irregularities arising from the causes referred to; that is, as far as leakage may affect performance, the results of the laboratory tests may safely be accepted as a record of maximum performance.

In concluding this brief review of the difficulties encountered in the operation of locomotives under very high steam pressures, the reader is reminded that an increase of pressure is an embellishment to which each detail in the design of the whole machine must give a proper response. A locomotive which is to operate under such pressure will need to be more carefully designed and more perfectly maintained than a similar locomotive designed for lower pressure; and much of that which is crude and imperfect, but nevertheless serviceable in the operation of locomotives using a lower pressure, must give way to a more perfect practice in the presence of the higher pressure.

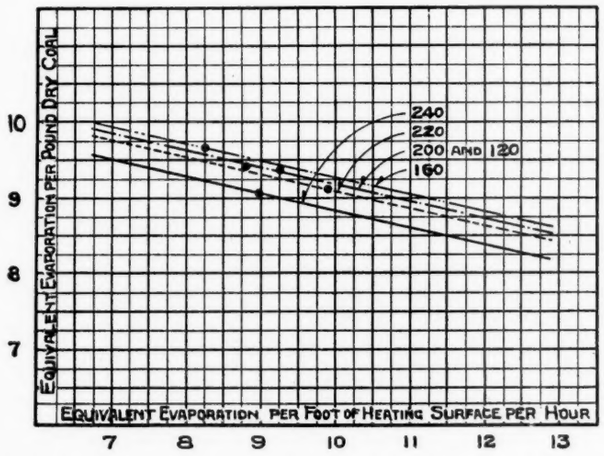


Fig. 8—Evaporation Per Pound of Coal Under Different Conditions of Pressure.

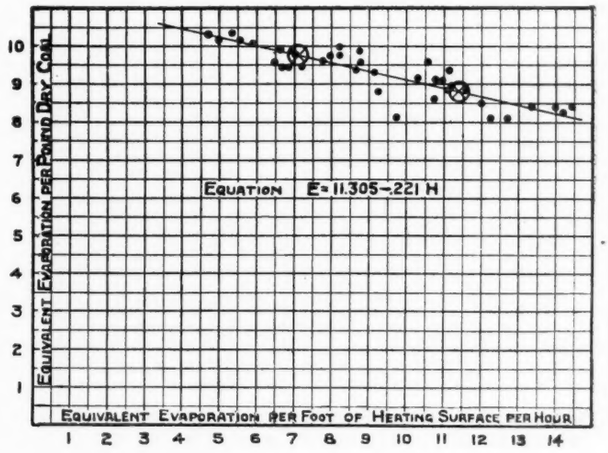


Fig. 9—Evaporation Per Pound of Coal Under All Conditions of Pressure.

III. BOILER PERFORMANCE.

7. *The Performance of the Boiler.*—The pounds of water evaporated per pound of coal plotted in terms of rate of evaporation are shown for each of the several pressures in Fig. 8. The equations representing the performance of the boiler and furnace as established by these lines are:

$$E = 11.040 - .221\ H, \text{ when pressure is } 240$$
$$E = 11.310 - .221\ H, \text{ when pressure is } 220$$
$$E = 11.373 - .221\ H, \text{ when pressure is } 200$$
$$E = 11.469 - .221\ H, \text{ when pressure is } 160$$
$$E = 11.357 - .221\ H, \text{ when pressure is } 120$$

where E is the number of pounds of water evaporated from and at 212 deg. per pound of coal, and H is the number of pounds of water evaporated from and at 212 deg. per sq. ft. of heating surface per hour. The area of heating surface employed is based upon the interior surface of the firebox and the exterior surface of the tubes. In determining the posi-

tion of the lines represented by these equations certain conventions were adopted. These, and the reasons underlying them, may be described as follows:

The only difference in the running conditions applying to the tests of each series is that of pressure, and as the terms employed in plotting the several diagrams are the same, it is evident that the differences in performance are only such as may result from the difference in pressure. Since the quantities are in terms of equivalent evaporation, the differences cannot be great. Accepting this view, it was first sought to determine the slope of the lines for the several groups. This was done by plotting upon a single sheet all the points, eight in number, available for the series at 240 lbs., together with eight points selected as fairly representative from each of the other series, making 40 points in all. The result is shown in Fig. 9. Points thus plotted were divided into two groups, one representing the lower rates of combustion, and the other representing the higher rates, the points being so chosen that each group contained four points from each of the several series. The ordinates and abscissæ for points of each group were then determined, and the several values thus obtained averaged. The final results were then plotted, giving the points shown by the circles inclosing a cross (Fig. 9).

The equation from the line drawn through these points is

$$E = 11.305 - 0.221\ H$$

The line thus found (Fig. 9) may fairly be assumed to represent the slope of the mean line of any number of points which for purposes of comparison may be selected from the larger group.

In determining, therefore, the location of the mean lines (Fig. 8), the abscissæ and ordinates of all points were averaged and the results plotted. Through the derived point a line is drawn having the slope already found; that is, the mean line of Fig. 9.

8. *Effect of Changes in Steam Pressure upon the Evaporative Efficiency of the Boiler.*—The generation of steam at a pressure of 120 lbs. involves a temperature of the water which is 50 deg. less than that which must be dealt with in generating steam at a pressure of 240 lbs., and in general it has been assumed that any increase in boiler pressure necessarily results in some loss of evaporative efficiency. It has been known that for the small ranges of pressure common in stationary practice this difference is not great, but the facts have not been established with reference to locomotive performance or for ranges as great as those covered by the experiments under consideration in any service.

The performance of the boiler experimented upon under a range of pressure varying from 240 to 120 lbs. may be seen by comparing the mean curves already developed (Fig. 8). This diagram shows that the lowest efficiency is obtained with the highest pressure and that with one exception the lines representing performance under different pressures fall in order, inversely with the pressure. The exception is to be found in the line representing performance at 120 lbs. pressure. This line falls low, a condition which may be explained by the fact that the spark and cinder losses for these tests are known to have been excessive. The mean line located from 40 points, representing all pressures (Fig. 9), will represent any of the lines of Fig. 8 with an error not greater than 0.2 lbs.

The results clearly define four general facts, which may be stated as follows:

(a). The evaporative efficiency of a locomotive boiler is but slightly affected by changes in pressure.

(b). Changes in steam pressure between the limits of 120 lbs. and 240 lbs. will produce an effect upon the efficiency of the boiler which will be less than 0.5 lbs. of water per pound of coal.

(c). The equation $E = 11.305 - 0.221\ H$ represents the evaporative efficiency of the boiler of locomotive Schenectady No. 2 when fired with Youghiogheny coal for all pressures between the limits of 120 lbs. and 240 lbs. with an average error for any pressure which does not exceed 2.1 per cent.

9. *Smokebox Temperatures.*—The results of the tests show that in all cases the temperature of the smokebox gases increases as the rate of evaporation increases. Plotted diagrams showing the exact relationship indicate a marked similarity for all pressures; all have the same slope and if superimposed they would fall very closely together.

Thus, they show that when the rate of evaporation is 9 lbs. per foot of heating surface per hour, the smokebox temperature for all pressures is between the limits of 700 deg. F. and 730 deg. F. There are but four results for a pressure of 240 lbs., in comparison with eight or more for other pressures. If the results from the tests at 240 lbs. pressure be omitted it will be found that those remaining, which represent a range of pressure from 220 to 120 lbs., are nearly identical. This is best shown by the equations of the curves in question, which are given in Table 1.

Boiler-pressure pounds	Equations
220	$T = 496.3 + 25.66\ H$
200	$T = 491.0 + 25.66\ H$
160	$T = 487.7 + 25.66\ H$
120	$T = 478.9 + 25.66\ H$
Average	$T = 488.5 + 25.66\ H$

Table 1—Smokebox Temperatures Under Different Pressures.

The average of the several equations represents the average of any of the several groups of results obtained under different pressures, with an error which in no case exceeds 10 deg. F., or 2 per cent.

Again, the equations show that the effect of increasing the pressure from 120 to 220 lbs. is to increase the smokebox temperature 17 deg.; that is, an increase of pressure of nearly 100 per cent. results in an increase of smokebox temperature of approximately 3.5 per cent.

In the preceding statements is to be found an explanation of the constancy in the evaporative efficiency of the boiler under different steam pressures. The fact seems to be that the water in the boiler is about as effective in absorbing the heat of the gases when its temperature is 400 deg. (240 lbs. pressure) as when its temperature is but 350 deg. (120 lbs. pressure).

The data sustain the following conclusions:

(a). The smokebox temperature falls between the limits of 590 deg. F. and 850 deg. F., the lower limit agreeing with a rate of evaporation of 4 lbs. per ft. of heating surface per hour and the latter with a rate of evaporation of 14 lbs. per ft. of heating surface per hour.

(b). The smokebox temperature is so slightly affected by changes in steam pressure as to make negligible the influence of such changes in pressure for all ordinary ranges.

(c). The equation $T = 488.5 + 25.66\ H$, where T is the temperature of the smokebox expressed in degrees F, and H is pounds of water evaporated from and at 212 deg. per ft. of heating surface per hour, possesses a high degree of accuracy.

10. *Draft.*—The term "draft," as herein employed, represents a reduction of pressure as compared with that of the atmosphere expressed in inches of water. The draft was observed at three different points between the ash-pan and the stack. These were the smokebox in front of the diaphragm, the smokebox back of the diaphragm, and the firebox. At each of these points connection was made with a U-tube containing water. The results for each different steam pressure vary but little so that those representing the draft as affected by rate of evaporation for any one pressure, for example, 160 (Fig. 10), are fairly representative of the entire exhibit.

Referring to Fig. 10, the solid points represent the draft in the smokebox in front of the diaphragm; the crosses, the draft behind the diaphragm, and the circles, the draft in the firebox. Expressing the results in other terms, it appears that vertical distances between the highest curve and the intermediate represent the resistance of the diaphragm; vertical distances between the intermediate and the lowest curve, the resistance of the tubes, and vertical distances between the lowest curve and the axis, the resistance of the ash-pan, the grate and the fire upon it. Values under this curve are a close approach to the effective draft. In general, draft values vary greatly with the conditions at the grate. A thin, clean fire results in comparatively low draft values throughout the system, while a thick fire, or one which is choked by clinkers, leads to the reverse results. It is for this reason that individual points representing draft sometimes vary widely from the mean of all results.

When the rate of evaporation is 10 lbs. per ft. of heating surface per hour, the draft in front of the diaphragm is approximately 4 in. for all pressures.

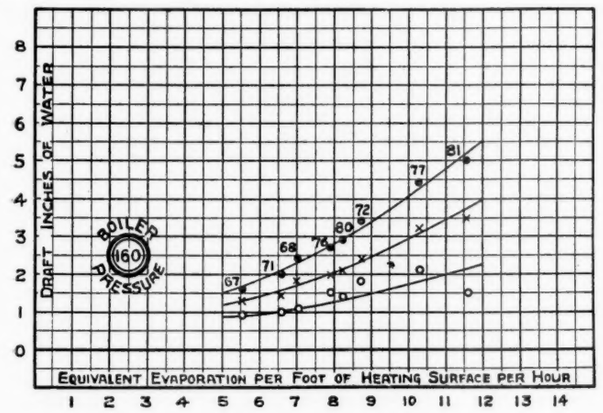


Fig. 10—Draft.

11. *Composition of Smokebox Gases.*—As previous experiments had shown irregularities in the evaporative efficiency of boilers of locomotives, it was early decided to proceed with care in determining the composition of the smokebox gases. It seemed probable that if the composition of these were known for each test, variations in the evaporative efficiency of the boiler might be explained. To this end, therefore, each step in the process was carefully considered, and the work of sampling and analyzing the gases was assigned to a chemist of experience who had no other duties to perform.

The gases were drawn from the smokebox over mercury, a period of from a half hour to an hour and a half being employed in securing the sample. The sampling-tube was of copper and of small diameter. Its length was sufficient to extend to the center of the smokebox, and gas was admitted to it by small perforations at the extreme end only. This tube could be drawn in and out through a stuffing-box to permit the sample to be taken either from the center of the smokebox or from any location between that point and the shell. In securing the sample it was the practice to move the tube systematically at regular intervals of time. By these means it was assumed that abnormal results due to fluctuations in the condition of the fire would be entirely avoided.

The results, notwithstanding all precautions, have not proved entirely satisfactory; that is, where the evaporative performance is abnormal, they do not permit the assignment of a definite cause. The defects are doubtless due to faulty sampling, though it is not clear in what manner the sampling may be improved in connection with locomotive work. They do, however, entirely justify certain general conclusions. They show that the amount of excess air admitted to the furnace is never great, and in most cases it is very small—far below the limits which are thought desirable in stationary practice. They show, also, that the excess air diminishes as the rate of combustion increases. It is apparent, therefore, that the loss in efficiency arising from excess air is under normal conditions smaller than in most other classes of service. Moreover, while the supply of air appears limited, it is significant that the losses from imperfect combustion, as shown by the presence of CO, are also small, the actual amount varying irregularly between limits which are very narrow.

12. *The quality of steam* was uniformly high under all conditions for pressure, the average for all tests being 99.08. The quality declined slightly with increase of pressure, but in no case did the moisture exceed 1.35 per cent.

(To be continued.)

TELEPHONE CALLING APPARATUS.

The Cummings & Wray calling apparatus for use on train despatchers' telephone lines is now in service on the two busiest divisions of the Chicago, Milwaukee & St. Paul; on two divisions of the Delaware, Lackawanna & Western, and on one or more divisions of the Chicago, Burlington & Quincy, the Atchison, Topeka & Santa Fe, the Great Northern, the Michigan Central, the Chicago & North Western, the Louisville & Nashville and the Chicago, Rock Island & Pacific. The apparatus is made both by the Western Electric Company, Chicago, and the Kellogg Switch & Supply Company, Chicago.

The essential element in this calling system consists of synchronous clocks, one at the despatcher's office and one at each station. The first operation performed by the despatcher when he wishes to call a station is to close a circuit which starts all the clock movements in the system, all having been held at zero by a detent which is released by a relay. The second hand of each clock sweeps over a series of contacts, closing each successively; and each of the 28 or more contacts is assigned to one of 28 stations. For example, if station No. 10 is the one to be called, the despatcher presses a key which causes a current to be sent to the line when the second hand of his clock passes over its tenth contact. At station No. 10 the clock contact for the local apparatus at that station is closed, at the same moment, by the local clock, and the calling relay at that station being thus switched into the main line, closes its points, energizing a local circuit which rings a bell. This relay, being a "stick" relay, holds the bell circuit closed until the operator heeds the bell and opens the bell circuit. At all other stations the clocks are arranged to leave the local circuits open during the passage of the second hand over the tenth point, and therefore no other station is called. Where it is desired to call two or more offices at the same time, the despatcher at the outset (after starting the clocks) closes keys corresponding to the different points on the clock dial, and he could in that way call the whole 28 offices successively. The 28th would be called in about 28 seconds after the clocks were started. The offices most frequently called are arranged to have their local connections closed in the first part of the journey of the clock pointer over its dial, and those which are called less frequently are arranged in the latter part of the dial, where more time is required. The 28 keys are arranged in a row across the front of the despatcher's box containing the clockwork and other apparatus. On train despatching wires the stations usually do no calling, the despatcher keeping the receiver constantly at his ear; but whenever he does not, a bell is switched in, and local stations can call by using a hand generator.

The designers of this apparatus have tested it thoroughly under all conditions, and have brought it to a very satisfactory state of efficiency. The synchronizing mechanism is a standard lever escapement clock movement. Instruments are made to call more than 28 stations where desired. By using the line circuit during only a fraction of a second for each call, disturbances by lightning or other foreign currents or discharges have been reduced to a minimum.

DYNAMOMETER CAR OF THE UNIVERSITY OF ILLINOIS AND THE ILLINOIS CENTRAL RAILROAD.

BY F. W. MARQUIS.

The dynamometer car here described belongs jointly to the Railway Engineering Department of the University of Illinois and the Illinois Central Railroad. It is designed for general experimental work on steam roads, and is especially adapted for the determination of train resistance and for use in making locomotive road tests. It was originally built and equipped in 1900, and was operated as then equipped until 1907, during which period it was used in locomotive tonnage rating tests over practically the entire Illinois Central system. It was also used on the New York Central in tests which were made in connection with the electrification of its New York terminal, as well as on the New Jersey Central and the Baltimore & Ohio. A description of the car as originally equipped appeared in the *Railroad Gazette* of June 30, 1900. The co-operation of the railway and the university in the construction and operation of this car was made possible by the interest of William Renshaw, formerly Superintendent of Machinery of the Illinois Central. The plan has proved entirely satisfactory to all concerned, the university having had unusual facilities for carrying on its instructional and research work, while the railway, on the other hand, has had available at all times a skilled corps of test car operators who have made such tests and reports as have been described by its officials. The car has been operated at all times by representatives of the university, and all tests have been participated in by students of the Department of Railway Engineering.

In 1907 this car was dismantled and rebuilt, the old recording apparatus being discarded and replaced by new equipment, which is here described. An outside view of the car is shown in Fig. 1, inside views in Figs. 2 and 3, and a floor plan in Fig. 4. It was originally built particularly heavy, in order to withstand the usage it receives in freight service, and when rebuilt the center sills were reinforced by continuous steel channels and steel platforms were added. It is 45 ft. 4 in. long, and 40 ft. over the end sills, 8 ft. 4⅜ in. wide inside, 9 ft. 1⅝ in. outside, with an extreme width of 10½ ft. over the observation windows. The height from the rail to the roof

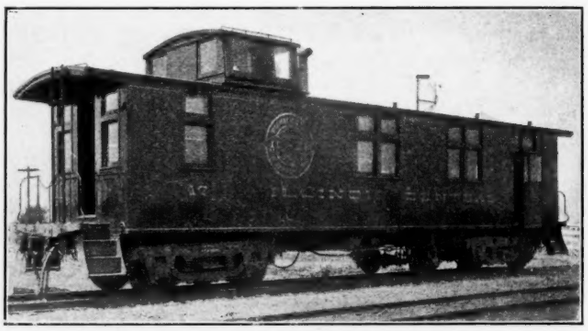


Fig. 1—Dynamometer Car; University of Illinois and Illinois Central Railroad.

is 12 ft., and from the rail to the top of the cupola 14 ft. 10 in. About 15 ft. in the rear end is occupied by the berths, lockers, closets and toilet room, leaving 25 ft. working space, in which the recording apparatus, work benches, etc., are placed. The car is lighted by electricity, being supplied with an axle light equipment made by the Bliss Electric Car Lighting Co.

Views of the new recording apparatus are shown in Figs.

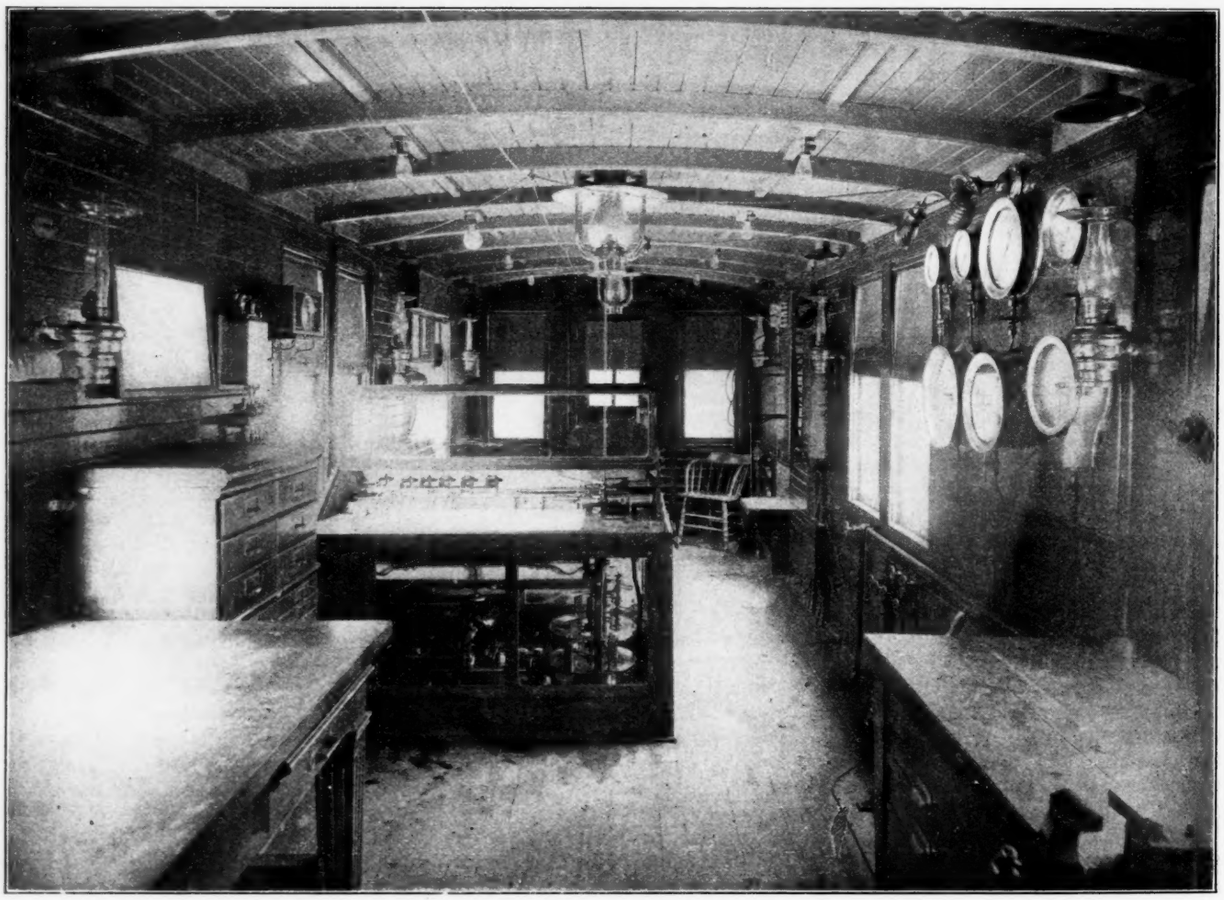


Fig. 2—Interior of Dynamometer Car.

5 and 6. It provides means for obtaining a continuous graphical record of the following data: Curve of drawbar pull, speed curve, record of work performed by locomotive at tender drawbar, curve of power developed by locomotive at tender drawbar, curve of acceleration, record of time, record of position of mile posts, stations, etc.; record of throttle opening, record of reverse lever position, record of locomotive boiler pressure, record of air-bake applications, record of wind direction, record of wind velocity.

Besides the above, any data which prove of interest in special tests, such as time of taking indicator cards, etc., may be recorded upon the chart by means of additional pens provided for such purposes. All of the above data are recorded in the form of curves or lines, with offsets, on a continuous strip of paper 36 in. wide, which travels across the top of the recording table. This paper can be driven either at a constant speed by means of a motor, current for which is supplied by the storage battery which forms a part of the axle light equipment; or at a speed proportional to the speed of the car. In the first case the records are obtained on a time base, in the second on a distance base. In the latter case the paper is driven from the axle of an auxiliary two-wheeled truck, which can be seen in Fig. 1. This truck is so constructed that its wheels can be lifted from the rails from within the car. They are never run except during a test. A sectional view showing the transmission gear from this truck is shown in Fig. 8. It may be seen from this figure that a vertical shaft, extending up into the car, is driven from the truck axle by means of two pairs of bevel gears, which are carried in a cast iron gear case and run in oil. This vertical shaft is provided with two universal joints and a slip joint, which permit relative motion between the truck wheels and car body. At its upper end it carries a bevel gear, which meshes with two other bevel gears carried on a horizontal shaft, which may be seen near the bottom in Fig. 5. These two bevels are so attached by means of a ratchet device to the horizontal shaft, that it is driven in the same direction for both directions of car travel. This horizontal shaft so drives the paper (through a clutch and a

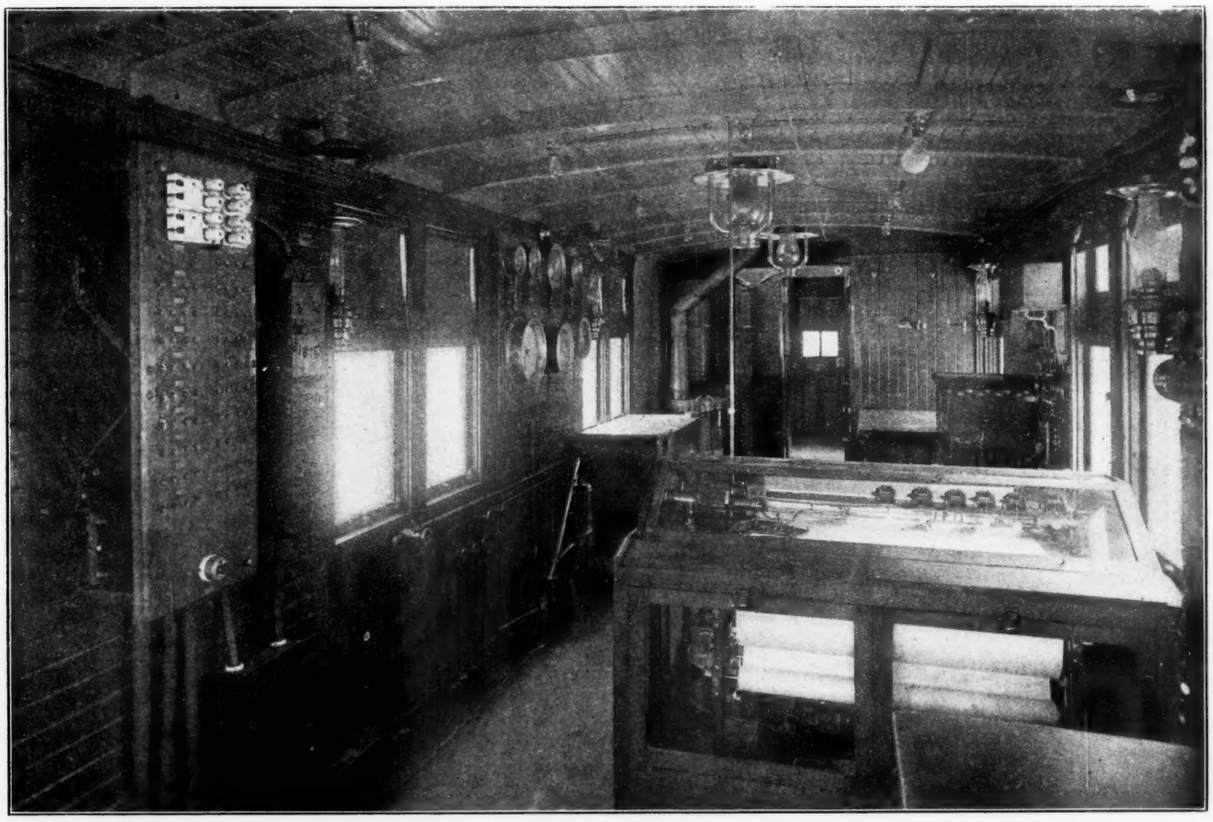


Fig. 3—Dynamometer Car, Interior View.

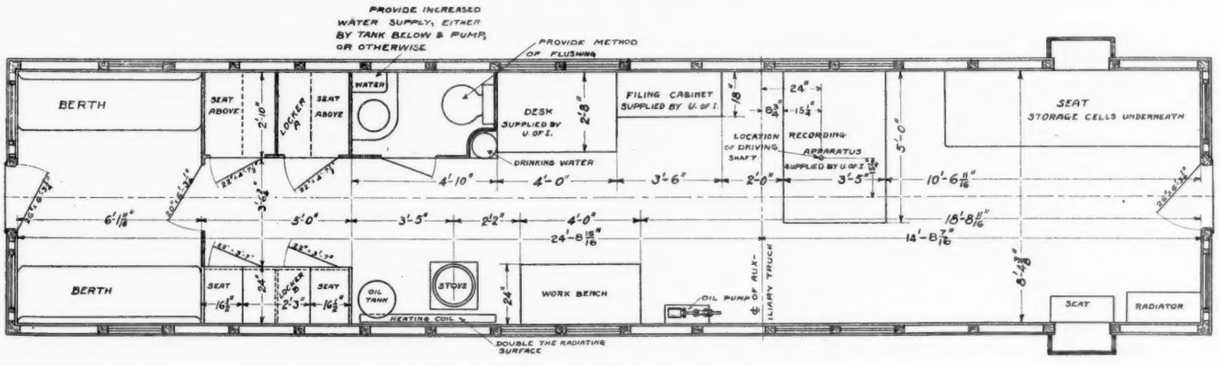


Fig. 4—Plan of Dynamometer Car.

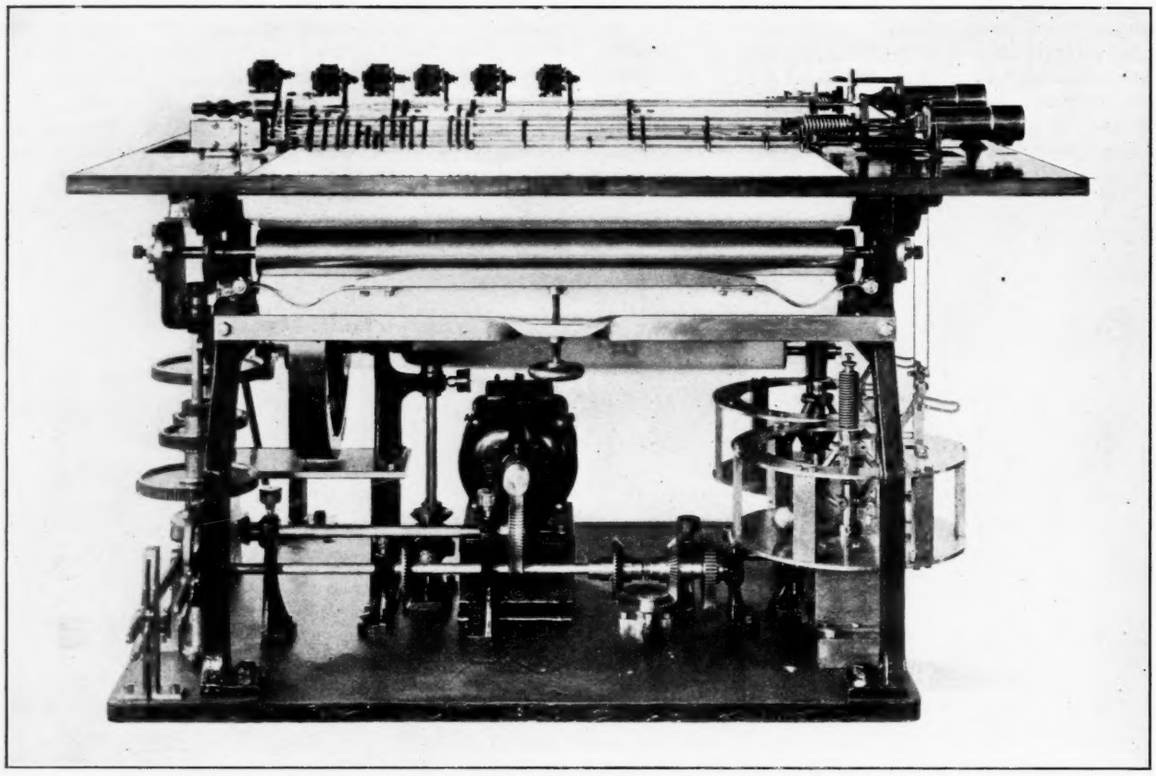


Fig. 5—Recording Apparatus, Front View.

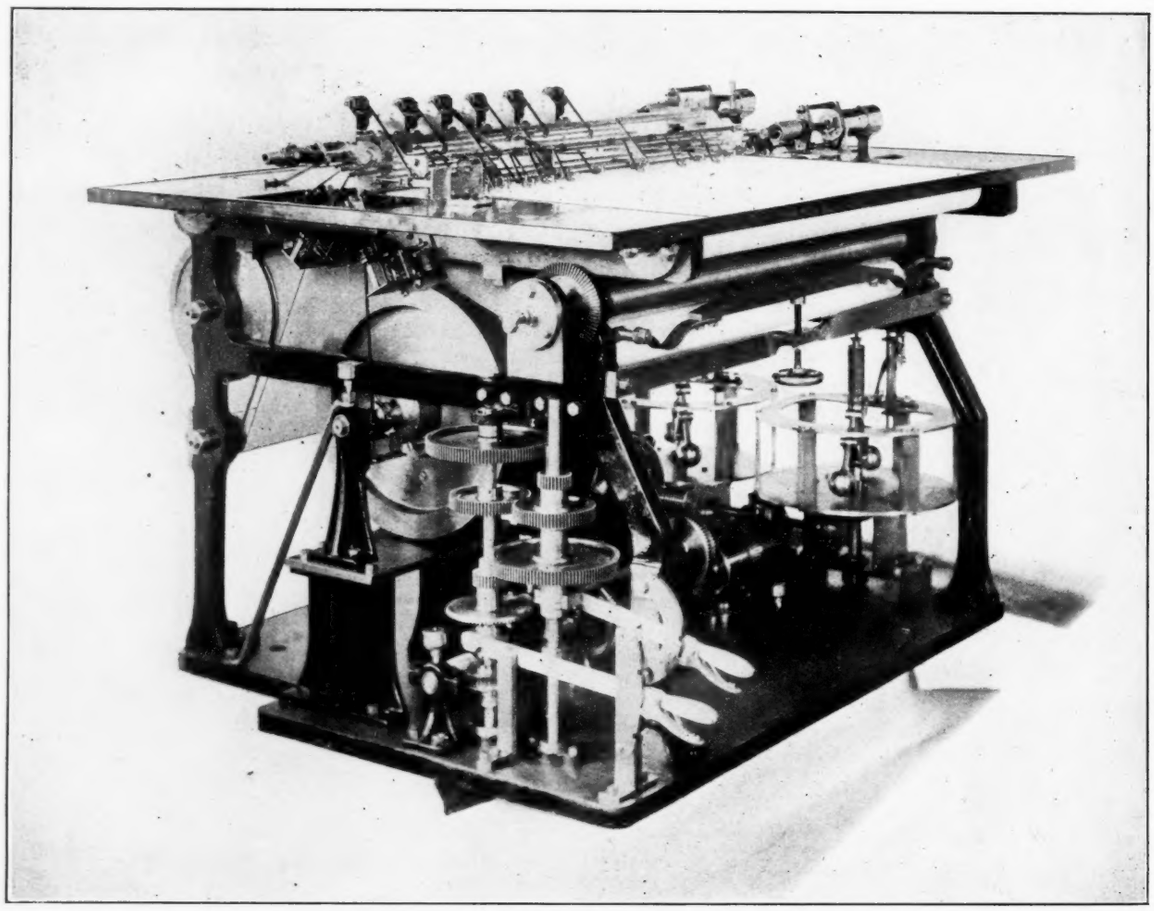


Fig. 6—Recording Apparatus, Side View.

set of change speed gears) that the paper travel is in the same direction at all times. The lower lever shown at the left in Fig. 6 operates the clutch, by means of which the paper may be driven either from the motor, or from the center truck axle, or it may be thrown out of connection with both of these. The upper lever controls the change speed gears, by means of which the paper may be driven at a constant speed of 3¾, 15 or 60 in. per minute, or $\frac{1}{10}$, ¼ or 1 in. per 100 ft. of car travel.

The recording apparatus as a whole is entirely self-contained, and is mounted on a heavy cast iron base plate. As mounted in the car it is enclosed in a glass case to protect the instruments from dust and grit. All of the active recording pens are arranged to move in a straight line at right angles to the direction of paper travel. Motion is communicated to the pens from the various parts of the apparatus by hollow aluminum rods, lightness being thus secured to diminish disturbance due to inertia and friction. The datum or zero pens are arranged in a straight line 1½ inches ahead of the line in which the active pens move.

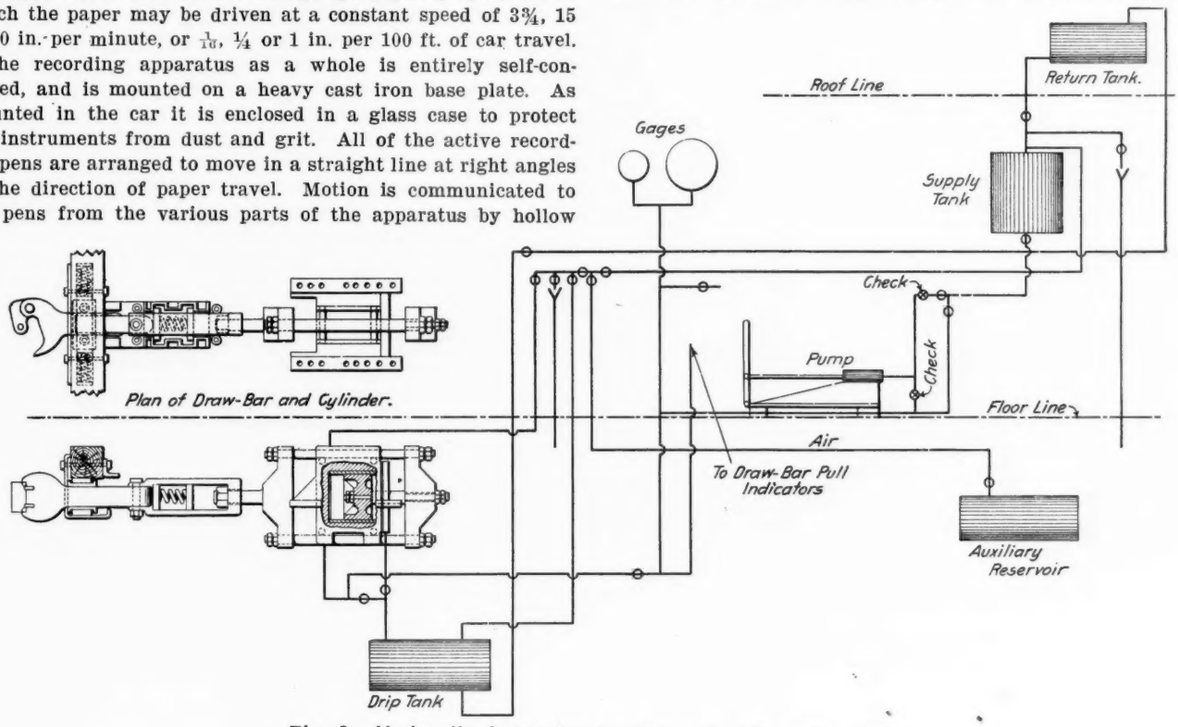


Fig. 9—Hydraulic Apparatus for Measuring Draw-bar Pull.

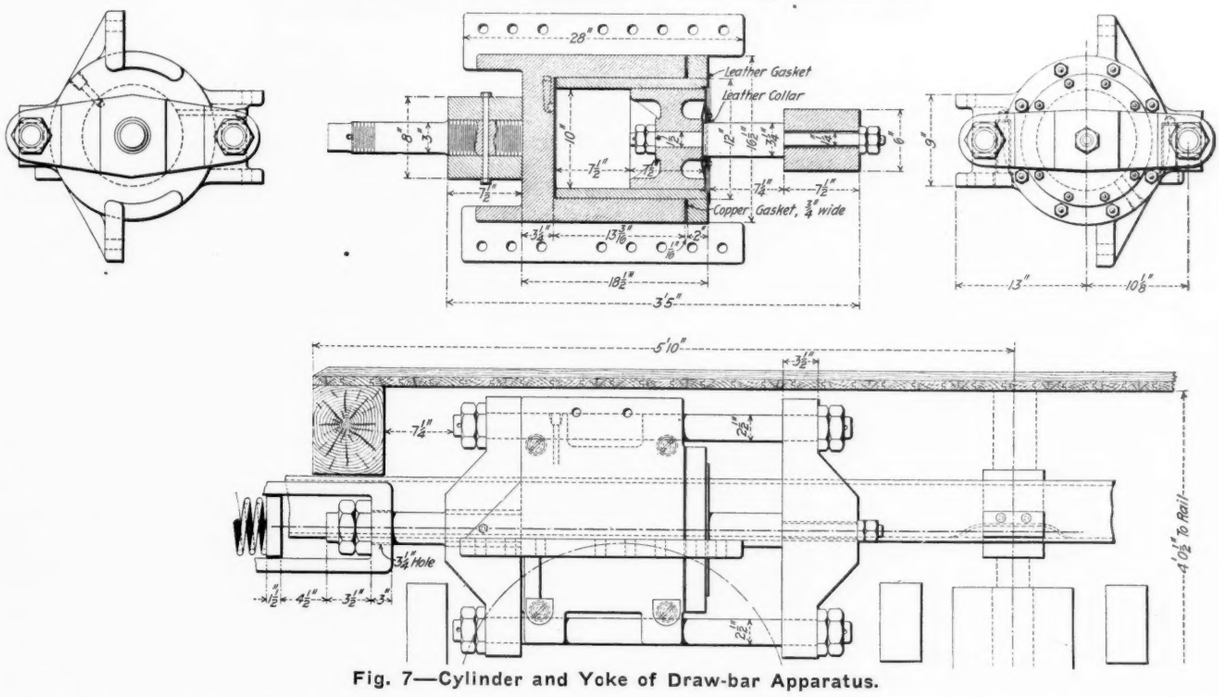


Fig. 7—Cylinder and Yoke of Draw-bar Apparatus.

DRAW-BAR PULL.

There are two methods of measuring and recording draw-bar pull used on dynamometer cars. In the first and more common method the pull is received upon heavy calibrated springs, the deflection of which is transmitted by levers and links to the recording pen. The accuracy of the results in this system depends, first, upon the calibration of heavy springs, which is in itself a tedious and difficult operation; and second, upon the absolute rigidity of the framework which carries the power transmission system. This framework necessarily extends from the springs below the car to the recording pen within and, under the stresses to which a dynamometer car is subjected, rigidity in this framework and fixity of relation between fulcrum points of levers is hard to get.

In the second method the draw-bar pull is received on the piston of a cylinder placed below the floor and filled usually with oil. The oil pressure resulting from the pull is transmitted by piping to a small indicator cylinder on the record-

ing table. The pull is ultimately measured by the spring of the indicator; but this spring is much more easily calibrated than the larger springs of the other system, and, moreover, the accuracy of the results by the second method is in no way affected by relative motion between the large cylinder below the car body and the recording table.

For the reasons above indicated the University of Illinois car was fitted with a hydraulic transmission dynamometer when originally built in 1900, and the system has been retained in the new equipment, although it differs materially in details from the original design. The new design is shown in the diagram in Fig. 9.

A heavy cast iron cylinder with an inside diameter of 10 in. is fastened to the underframing of the car near the front end, in line with the drawbar. The pull upon the draw-bar is taken against oil contained in this cylinder. The pressure upon the oil, caused by the draw-bar pull is transmitted to the recording indicator which forms a part of the recording apparatus. Fig. 9 shows a sectional view of the cylinder, and also the system of oil piping. Since the working pressure in the oil is rather high (a little over 1,000 lbs. per square inch for a draw-bar pull of 80,000 lbs.) it is necessary to take every precaution against leakage. Both the piston and the cylinder bore are ground, since any form of piston packing is inadmissible on acount of its friction.

In order to avoid the difficulties attending the use of a stuffing-box around the piston rod, the particular form of cylinder construction shown was adopted. The cylinder casting is built solid in front, the piston rod extending toward the

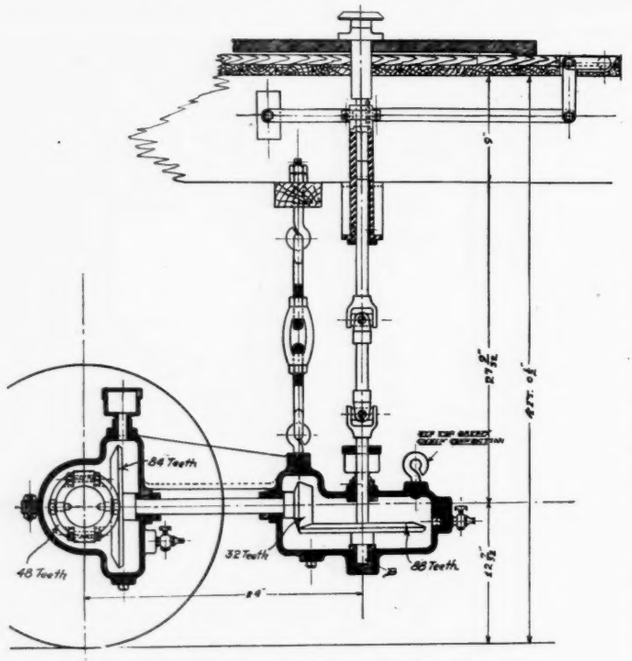


Fig. 8—Transmission Gear from Car Axle.

back from the piston. The pull on the draw-bar is delivered to the piston as a thrust from behind by means of the yoke connection shown in Fig. 9. With this construction the leakage has proved to be small and easily taken care of. The only result of leakage is that the piston is allowed to travel slowly forward in the cylinder. By means of an electric "telltale" device, an alarm bell is automatically rung before the piston reaches the end of its travel. Fresh oil is then forced into the cylinder by means of a pump provided for that purpose. This may be done during the progress of a test and without invalidating the draw-bar pull record. Even in heavy freight work, when the draw-bar pull is great and the speed slow, it is seldom necessary to thus replace oil in the cylinder oftener than every 25 or 30 miles. The oil which leaks by the piston drains into the drip tank shown in Fig. 9, and from there is forced back through the return tank and into the supply tank by air pressure.

In order to lessen friction due to side pulls on curves, the draw-bar is connected to the draw-bar yoke by means of a pin about which it can swivel. Besides this, both the draw-bar and yoke are guided between rollers. This construction is also shown in Fig. 9.

The draw-bar pull recording indicators, which are provided in duplicate, for reasons to be stated later, may be seen on

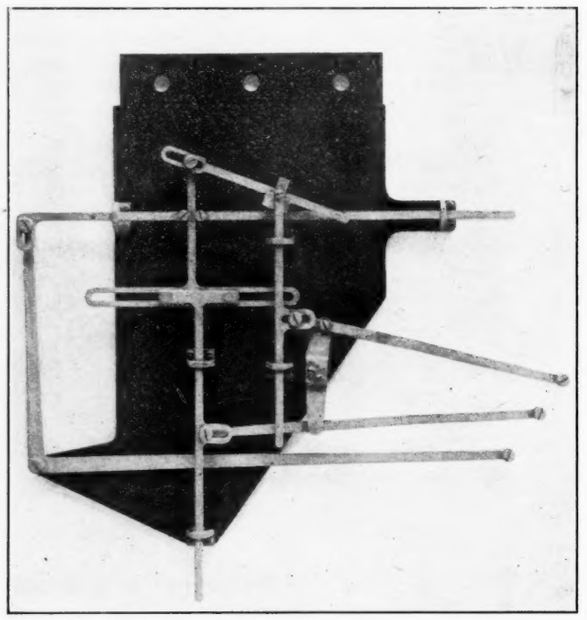


Fig. 10—Horse-Power Recorder.

top of the table at the right in Figs. 5 and 6. They are built by the Crosby Steam Gage & Valve Company, and are similar in design to the outside spring Crosby steam engine indicator, but much larger. One special feature in their design is that three different pistons, having areas of ½, 1 and 1½ sq. in., respectively, may be used in them, a different bushing with a bore to fit the piston being used in each case. By changing these pistons and using different springs, it is possible to make use of the total 6 in. of available pen travel in all classes of work, from the lightest passenger trains to the heaviest freight trains.

SPEED RECORD.

Two types of speed recorder are used, one for high and the other for low speeds. The high-speed recorders, which are provided in duplicate, are of the centrifugal type, and are used for speeds above 15 miles per hour. In their construction knife edges were used where possible, in order to reduce friction to a minimum. They were also designed so that they are not affected by the jolts and vibrations of the car. It was desired to have the movement of the speed pen proportional to the changes in speed, or, in other words, to have equal changes in speed represented by the same pen movement throughout the total range. In order to accomplish this it was found necessary to use a cam with a properly shaped profile. For low speeds a Boyer speed recorder (geared up so that it runs much faster than usual) is used. Its upper limit is about 25 miles per hour.

RECORD OF WORK DONE BY THE LOCOMOTIVE.

When the paper is driven at a rate which is proportional to the car travel, the area under the curve drawn by the draw-bar pull pen is a measure of the work done by the locomotive at the tender draw-bar, assuming that the measuring draw-

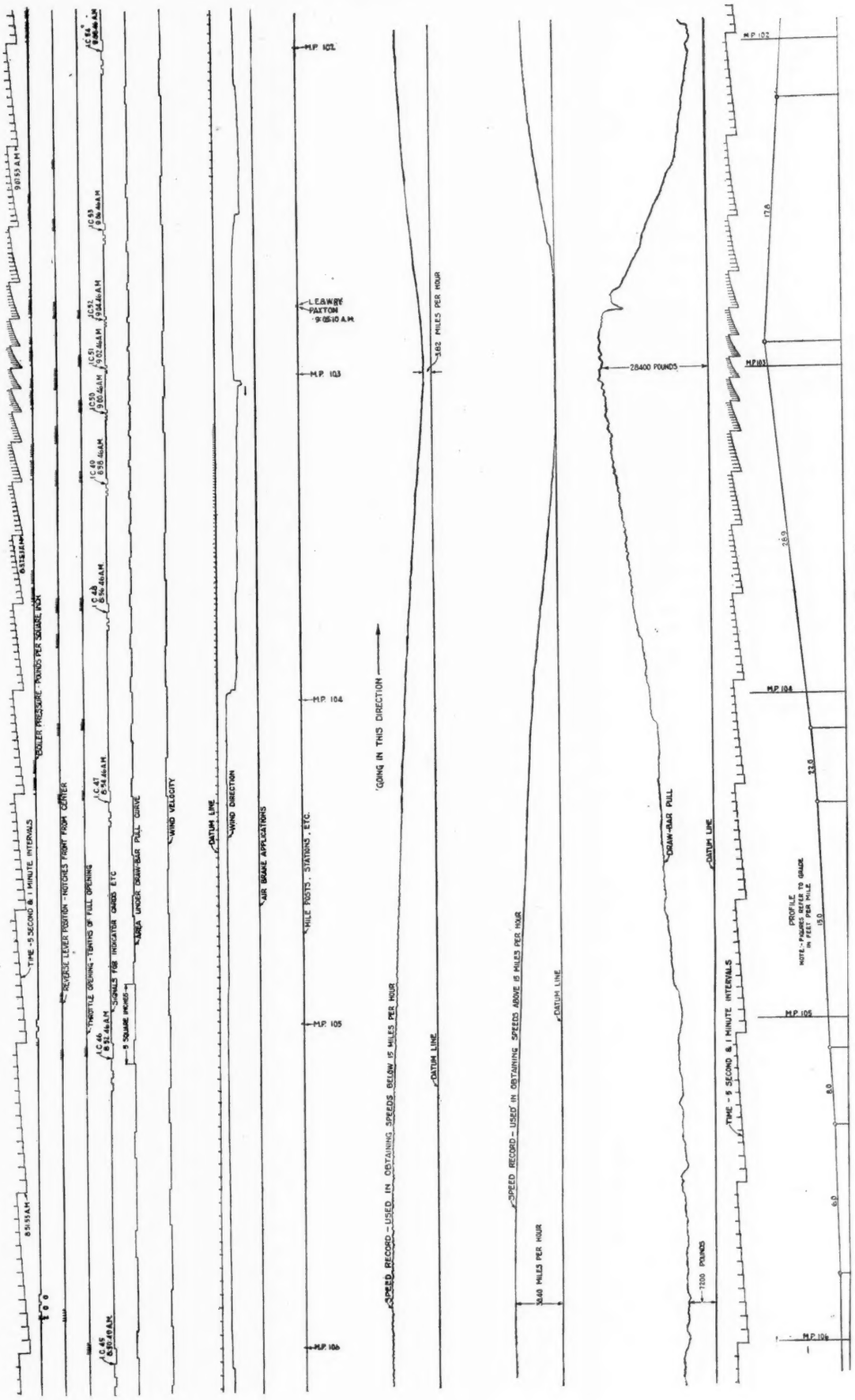


Fig. 11—Sample Dynamometer Record.

bar of the test car is attached to the tender draw-bar. This area is measured and recorded by a specially designed planimeter, which rests on the chart and is attached directly to the draw-bar pull pen rod. Its record is made by a pen controlled by an electro-magnet, the circuit through this electro-magnet being closed by the planimeter at the completion of each 5 sq. in. of area under the draw-bar pull curve.

TIME RECORD.

The time record is made by a pen which is moved by a cam controlled by an electro-magnet. The circuit through this electro-magnet is closed every 5 seconds by a special clock. The cam is so constructed that the pen is drawn about $\frac{1}{16}$ of an inch to one side every 5 seconds for one minute, when it is returned the total distance it has traveled during the minute, and starts over again. It thus draws a line, which shows both 5 second and 1 minute intervals. For convenience in working up the chart two time records are provided, one at each edge of the chart.

OTHER RECORDS.

The wind direction and velocity records are made by a wind vane and anemometer, which may be seen above the car roof in Fig. 1. They give the direction and velocity of the wind relative to the car. Since the speed and direction of motion of the car are known, the absolute direction and velocity of the wind may be obtained. It is probable that the air disturbances set up around the sides and roof of the car render untrustworthy the records from these two instruments. Sufficient experience has not thus far been obtained to warrant conclusions concerning the accuracy of their records.

The record of air-brake applications is made by a standard steam engine indicator, to which pressure from the brake cylinder is piped. It thus gives a record showing the number of applications, their duration and intensity. The mile-post pen, which is controlled by an electro-magnet, draws a continuous line, and at mile posts, stations, etc., is drawn slightly aside by the magnet which is operated by an observer in the observation window. Records of the locomotive boiler pressure, throttle opening, reverse lever position, etc., are also made by pens which are controlled by electro-magnets. Wires are run to the locomotive cab, and observers there make the contacts which operate the magnets. Special codes are used in making these records. Besides the above, attempts were also made to record curves of acceleration and draw-bar horse-power, but neither of these recorders, due largely to imperfections in design, has proved entirely successful up to this time. The horse-power recorder is shown in Fig. 10. The arm projecting at the lower right-hand corner, as shown in the figure, is connected to the extra draw-bar pull recorder mentioned above, and the arm just above it, to the extra speed recorder. When these two lower arms are moved by these recorders proportionally to the draw-bar pull and speed, the third arm is so constrained by the connecting links that its movement is proportional to the product of the movement of the other two; that is, to the horse-power. This recorder has been operated since the car was put in service, but the friction within the mechanism has proved to be great enough to seriously affect the results.

The accelerometer consists essentially of a flywheel weighing about 60 lbs., driven through springs by an arm on a shaft whose speed of rotation is proportional to the car speed. Acceleration causes relative motion between the flywheel and shaft, and this motion is transmitted to a recording pen by means of cams. Difficulties arising from this cam system have thus far prevented the successful operation of this device. Changes will soon be made in the design of the accelerometer, which, it is hoped, will make it possible to obtain more reliable curves of acceleration than have thus far been secured.

Fig. 11 shows a sample section of an actual record made by the recording apparatus. A profile of the road, drawn subsequent to the making of the chart, is added at the bottom, since it is of assistance in interpreting some of the other records. No discussion of the charts seems necessary, since the significance of the various lines is indicated upon the record itself. The chart as reproduced is exactly as drawn during the progress of the test, except that some of the lettering has been added to explain the meaning of the record and the profile has been added as stated above. The mile-post numbers, indicator card numbers, time, etc., are, of course, stamped upon the chart during the progress of the test.

The changes in the car body and the design of the draw-bar arrangements were carried out by W. O. Moody, Mechanical Engineer of the Illinois Central, and by the courtesy of J. G. Neuffer, Superintendent of Machinery, all construction except that of the recording apparatus was done at the Burnside shops of the railway. The recording apparatus, the dynamometer cylinder, auxiliary truck, transmission gearing and general arrangements were designed by the writer, working under the direction of Prof. Edward C. Schmidt, of the Railway Enginering Department of the University of Illinois. The recording apparatus was also built under the direction of the university.

Since being again put in service in April, 1908, this car has been engaged principally in a series of train resistance experiments which are planned eventually to determine the influence of axle load, kind of cars, variations in car equipment, track curvature and temperature upon the resistance of both freight and passenger trains. Thus far the work has included principally tests to determine the influence of axle load upon freight train resistance and some studies of the effects of temperature. The results of the investigations are not yet ready for publication.

THE RAILWAYS AND THE PEOPLE.*

BY FRANK TRUMBULL,
President of the Colorado & Southern Railway Company.

The historian of the legislation of this period will marvel at the serious attempts by anti-trust laws to maintain the competitive idea alongside compulsory uniformity in rates, restraint of trade by labor organizations, and laws "with teeth in them" which have well-nigh destroyed the competitive motive. Is it not high time that we recognize, at least in the transportation world, the fallacy of the economic principle we have been exalting; that we try to co-operate more and compete less? If monopoly has slain its thousands, unbridled competition has slain its tens of thousands.

The population of the United States has thus far doubled every thirty years. During the lifetime of some of us it will be 125 million, and some of us will live to see it 150 million. Transportation necessities double faster than the population, and already we have seen the railways sadly overtaxed. How are all these people to be adequately served? Government ownership has been suggested and promptly discarded. Up to date there is only one answer—that is by private capital. In the absence of government ownership, we might perhaps describe the private capital which it is necessary to interest as an "employee," and we ought not to be surprised if that employee, like others, should want to have something to say about the compensation which it shall receive, and the general conditions under which it shall perform its work. If at the present time you would like to put your money into this great semi-public service, what are the terms of employment? In the first place, you do it with the knowledge beforehand that neither the state nor the federal government will furnish you any financial aid; nor will they lend you their credit; nor will they guarantee you anything. They will not even protect you against competition, as France has long since been wise enough to do; and this, in spite of the fact that unrestricted competition is not compatible with regulation. It is true you get one thing from the state; that is the right of eminent do-

* From an address to the Board of Trade of Fort Worth, Texas.

main. The state and the federal government have the right to take private property for public use, but they have been prudent enough not to put public money into the railway business. Hence they have said to railway corporations: "We will transfer to you for construction purposes the right to take private property for public use." And this is for the public benefit. If, for example, you should want to build a hundred miles of railway into an undeveloped territory, and ten communities in that territory should want the road, it would be intolerable that one community or one individual could prevent their being served. Apart from this element of public benefit, the practical working of the right of eminent domain, so far as the corporation is concerned, usually is the purchase of the right-of-way by the railway at a fair price, or in the case of disagreement, at a price fixed by the owners' neighbors. In the case of new construction, it usually happens that committees of individuals who are desirous of having the additional service, can, for some occult reason, purchase from the owners on more favorable terms than the railway corporation itself can do. The fact is, that in conveying to railways the right of eminent domain, the people are simply giving something to themselves. Under present conditions if you conclude to engage in the railway business, the "muniments, titles and franchises" which the orators say you get from the state, consist of this somewhat dubious right of eminent domain and

THE RIGHT TO BE REGULATED.

Should there be no regulation whatever? By no means! The right of the government to regulate corporations engaged in public service has been too long upheld and admitted to now be turned over. But the questions, "How far should the regulation go" and "What is a reasonable return upon your capital if invested in railways," must be answered by investors as well as by law-makers, for it takes two to make a bargain. In Great Britain the right to regulate the railways has long since been accepted as reasonable, but there they do a great deal to *protect* railways as well as to regulate them; and their rates are higher and their wages much lower than on American railways. There is this further difference between Great Britain and the United States; there they have only one Parliament, while in the United States we have forty-seven—forty-six states, plus Congress. It might be said, as regulation is conceded, that capital has been married to regulation. Probably most of us will agree that marriage is a good thing; but is polygamy? If there are no custom-house barriers to commerce between the states, why should there be barriers in the matter of transportation? Bear in mind that the bulk of the business of transportation is interstate or foreign commerce, and that of the wages distributed in your state thereby the bulk is earned in moving that commerce. If the federal government is to prescribe the rates at which it is to be carried, why should the states have power to interfere with the expenditure of the revenues and in other respects?

REGULATION OF RATES.

I have referred previously to rebates and rate wars. It is a fine thing for all of us that these evils are behind us. Discriminations against individuals or corporations, are no longer tolerated. There is, however, *apparently* another kind of discrimination, viz.: between communities. Freight is hauled right through Dallas, Texas, to Fort Worth, to Wichita Falls or Stamford and delivered at the latter places for the same prices that would be charged if delivered at Dallas; and similarly, freight is hauled through Pueblo and Denver, Colorado, to Fort Collins and other places similarly situated at just the same prices which would be charged if the haul terminated at Pueblo. Note I say that this is an *apparent* discrimination. Assume for argument's sake, that this is an evil, how can it be remedied? Government ownership does not solve the problem. In the case of the postoffice, for example, if I mail a letter to-night to New York and you mail one to Dallas, you pay two cents and I pay two cents. You are helping to pay for carrying my letter to New York. Why should you? It might be cured in one way, viz.: by making all rates per mile. This was tried in Australia and the result is that there are no interior cities in that great commonwealth. The fact is, it is impossible in any of these matters to be mathematically consistent. The best that can be done by any human being or government is to render substantial justice. Which would you rather have—substantial justice and your interior cities, or mathematical consistency and cities on the seacoast only? If the latter, what would become of the wheat fields of the Dakotas as compared with districts nearer the ocean, or with the cotton of North Texas or Oklahoma as compared with the cotton of South Texas? Fort Worth and Denver, and hundreds of other interior cities would be ruined and nobody ever witnessed such a business convulsion as would come to pass.

OVERCAPITALIZATION.

It is said the railways are over-capitalized and the people are taxed to pay dividends on watered stock. This is a feature of transportation which seems to have about the same fascination for many minds that a small galvanic battery has for children, and when they tackle the subject and try to formulate a precise remedy that will retain the energy of private capital, they go through about the same amount of wriggling that the children do in trying to let go of the battery. The same with the question of physical valuation of railways; it is one of those theories which please the imagination, but no one can say what the government could do with it after it had it, any more than what the government could do with a physical valuation of farms and farm improvements. The question of location, proximity to large centers of population, and a dozen other questions would, in either case, still have to be considered. And suppose the physical valuation of a railway and its capitalization were made to exactly agree. How long would the agreement continue?? Not thirty days! In fact, the divergence would commence forthwith, and fluctuations, up or down, would continue indefinitely. There is as little relation between capitalization or valuation and rate-making, as there is between the capitalization or valuation of a department store and the price of suspenders. The capitalization of railways in Great Britain is about $300,000 per mile, while in the United States the average is only $60,000. Those sections of the United States which have the highest railway capitalization have the lowest rates. The Chicago & Alton, concerning whose capitalization so much has been said, is now receiving a lower average rate per ton mile than four years ago, and it must make the same rates as the Illinois Central, the Wabash, or any competitor with a lower capitalization per mile. The Santa Fe must make the same rates between Fort Worth and Galveston as the Houston & Texas Central, and vice versa, regardless of the capitalization of either. In one respect railways may sometimes be said to be over-capitalized; that is, when there is no return, or a very meager return, on the capitalization. I have had the satisfaction of being connected with the curing of at least one such instance of over-capitalization by building additional mileage, for which, of course, additional capital was necessary. In other words, the over-capitalization was cured by the issue of more capital.

The national banks of the United States pay 13 per cent. dividends on their capital, and besides, properly add each year large sums to their surplus. Cotton mills pay as high as 66 per cent. dividends. I might multiply instances by citing the successes of many of you in this audience of which we are all proud. Let me quote only the following from a very interesting series of articles in the Dallas *News* last June and July:

"When finally the cattlemen were compelled to surrender to the farmers the country southward they moved into Childress and Hall counties, confident that there they could stay indefinitely unmolested by the clamor of men wanting to uproot the grass. Nine years ago Mr. S. bought one hundred thousand acres of land for a ranch. It was for that purpose and not for speculation that the land was bought, but two years ago the land came into such demand for agricultural pursuits that he found it profitable to sell out and move into Hall county. Now he is leaving Hall county. That is the way the cattle-

man is being made to 'move on.' For the Childress county land Mr. S. paid a price averaging $1.50 an acre; he sold it at a price averaging $7.50 an acre. The increment, in other words, has been about 50 per cent. a year, so that if progress has crowded the cattleman out, it has nevertheless paid him handsome damages."

Contrast this now with the railway situation. The last printed report of the Texas Railroad Commission states the total capital stock of Texas railways at 131 million dollars. During the year, dividends paid by railways amounted to $287,789.60, which was equivalent to about one-fifth of 1 per cent. on the whole capital stock just quoted. Most roads in Texas have never paid a cent of dividends. How then, if rates are reasonable and service good, can anyone, except the owners of the stock, possibly have been injured? If you are considering putting your money into the railway business, how are you to be attracted to this field of endeavor? Will you be satisfied with a statutory interest return on your investment, or would you like to "grow up with the country?" Perhaps the acquisitive faculty is lodged somewhere in your system. I doubt not it was planted in the human breast for some wise purpose. If it had not been, I suppose the Indians would have this country yet, particularly that part of it west of the Mississippi river. Now is it any more disgraceful to increase your fortune in building railways than in selling lands, or in any other occupation? The "predatory politician," will doubtless refer to you as "predatory wealth," but don't mind that; you will have the satisfaction of knowing that you are making it possible for thousands of employees of railways and allied industries to help themselves and making it possible for other thousands to live more comfortably than they could otherwise do. In other words, you will be a producer, while the "predatory politician" produces nothing; and perhaps you will find some consolation in remembering that in the parable, the condemnation was not upon the man with ten talents, but upon the man with one only.

CHINESE RAILWAY POLICY.

There are now about 4,000 miles of railway in operation in China, nearly as much as in all Japan. About as much more is under construction or survey, some 2,000 miles being actually under construction. The Board of Railways recently established by the government is a strong one and much is hoped for it. The government plans to take over as fast as possible all the railways in the empire. It is believed that this will be of great advantage both to the Chinese and to foreign makers of equipment and supplies. It will not tend to diminish railway extension under a progressive administration, and a great deal will be saved through the economy of standardizing equipment. Existing railways, which have been built under concessions to citizens of various foreign countries, use a number of different standards of rolling stock and other material. If this equipment is ultimately standardized, it will mean a good deal to American interests, as it is conceded that American locomotives, cars, bridges and rails are best suited to Chinese conditions. That this is understood by the Chinese is largely due to the teachings of Japanese engineers who have been trained in America. There is nothing at present to show that Japan will be able soon to build equipment for China. On the contrary, the Japanese, for some years to come, will have to buy equipment abroad to satisfy their own needs.

NEW LOCOMOTIVE EQUIPMENT; EAST INDIAN RAILWAY.

We illustrate herewith two new types of heavy passenger locomotives recently supplied to the East Indian Railway by the Vulcan Foundry, Limited, Newton-le-Willows, Lancashire, England. Both are intended for fast passenger service on the 5 ft. 6 in. gage main lines and, in many important respects, the dimensions are the same in both cases. The Atlantic type is the first engine of its kind to be employed on the East Indian Railway. It has outside cylinders driving the second pair of coupled wheels, and balanced Richardson slide valves worked by Stephenson link-motion inside the frames. The boiler barrel is made of steel plates 9/16 in. thick. It has a diameter at the front end 4 ft. 6¾ in., and a length of 13 ft. 7½ in., containing 201 tubes of 2 in. diameter and 14 ft. long between tube plates. The firebox is of the Belpaire type, 6 ft. 10 in. long inside at top, and 4 ft. 1⅛ in. wide, the depth at front being 6 ft. 4¼ in. and at back 5 ft. 4¼ in. The driving and coupled wheels have journals 8 in. by 9 in., the journals of the bogie wheels being 6½ in. by 8 in., and those of the trailing carrying wheels 7 in. by 12 in. Inside frames are used throughout, even the usual double framing for the trailing wheels being absent.

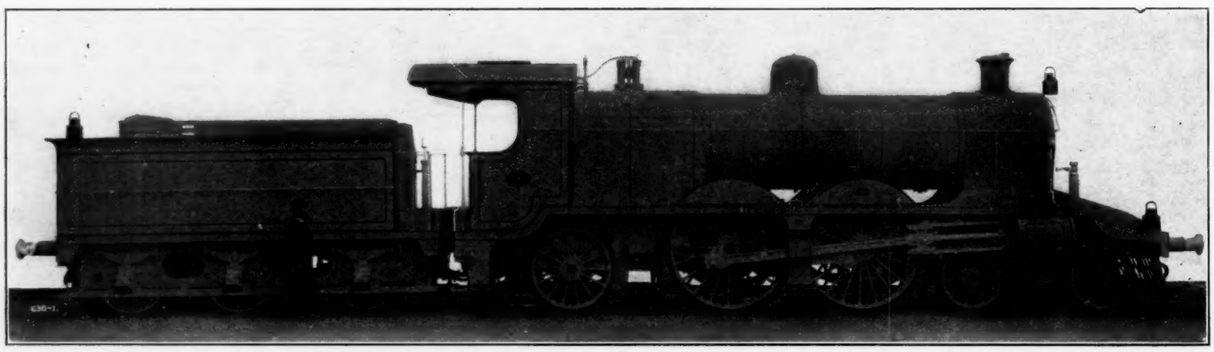


Fig. 1—New Atlantic Locomotive for the East Indian Railway.

The cab is of very commodious design, well covering the footplate, but no cab is provided at the front of the tender as is generally done on Indian locomotives. Taken as a whole, the engine presents an appearance more nearly in accordance with English standards than is the case with the majority of locomotives sent out to India.

A six-wheel tender is fitted, having a coal capacity of 5 tons, and holding 3,150 gallons of water. The leading dimensions are as follows:

Cylinders, diameter	19 in.
Piston stroke	26 "
Coupled wheels, diameter	78½ "
Bogie wheels, diameter	43 "
Trailing wheels, diameter	52 "
Wheel base, rigid	15 ft.
Wheel base, total engine	27 ft. 6 in.
Boiler heating surface, tubes	1,473 sq. ft.
" " " firebox	142 "
" " " total	1,615 "
Grate area	29.5 "
Working steam pressure, per sq. in.	180 lbs.

Weights in working order:

On bogie	35,280 lbs.
On coupled wheels	69,440 "
On trailing wheels	31,360 "
Of engine	136,080 "
Of engine and tender	220,080 "
Tractive effort	18,293 "

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 3.79$$

$$\frac{\text{Weight on drivers}}{\text{Total weight}} = 51.02^*$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 7.43$$

$$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}} = 913.93$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 54.74$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 18.26^*$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 43.00$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 84.16$$

$$\text{Displacement of 2 cylinders, cu. ft.} = 8.53$$

$$\frac{\text{Total heating surface}}{\text{Displacement, 2 cylinders}} = 189.33$$

$$\frac{\text{Grate area}}{\text{Displacement, 2 cylinders}} = 3.45$$

*Per cent.

The 4-6-0 type is also shown. As previously stated, many of the dimensions are the same in the case of this design as in that described above; the same proportions being retained for the cylinders, whilst the boiler is interchangeable. The coupled wheels are, however, smaller, although the rigid and the total wheelbase remain the same. The coupled wheels are 6 ft. 1½ in. diameter, as compared with the 6 ft. 6½ in. of the Atlantic locomotive, and, with an identical load per coupled axle in each case, the 4-6-0 type has 46½ tons of adhesion to the 31 tons of the 4-4-2 type.

Both classes of engine are fitted with Holden & Brooke's No. 8 m/m injectors, Dewrance's double bulls-eye pattern sight-feed lubricators, steam sanding apparatus and the automatic-vacuum brake.

These locomotives are among the largest and most powerful yet supplied to the East Indian Railway, and they rank among the most advanced standards for Indian railways. They have been built to a very careful specification and of rigidly selected materials. The total weight of the 4-6-0 type is 100 tons, with tender of exactly the same pattern as that fitted to the Atlantics.

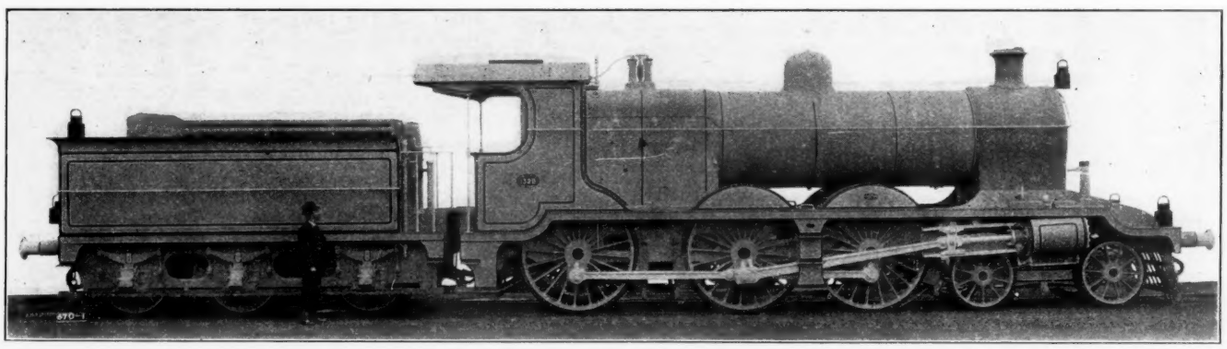


Fig. 2—New Ten-Wheel Locomotive for the East Indian Railway.

GOVERNMENT ACCIDENT BULLETIN NO. 29.

The Interstate Commerce Commission has issued accident bulletin No. 29 showing railway accidents in the United States during the three months ending September 30, 1908. The number of persons killed in train accidents was 191, and of injured, 3,046. Accidents of other kinds bring the total number of casualties up to 17,279 (734 killed and 16,545 injured). These reports deal only with (a) passengers and (b) employees on duty.

TABLE NO. 1.—*Casualties to Persons—July, August and September,* 1908

	Passengers		Employees		Tot'l persons reported	
	Kil'd.	Inj'd.	Kil'd.	Inj'd.	Kil'd.	Inj'd.
Collisions	43	1,025	58	546	101	1,571
Derailments	10	822	65	336	75	1,158
Miscellaneous train accidents.*	..	46	15	272	15	318
Total train accidents	53	1,893	138	1,154	191	3,046
Coupling or uncoupling	..	...	39	573	39	573
Other work abt. trains or switches	..	...	19	3,524	19	3,524
In contact with bridges, etc.	1	23	17	344	18	367
Falling from cars or engines or while getting on or off	37	833	127	2,548	164	3,381
Other causes	19	930	284	4,724	303	5,654
Total other than trn accidents.	57	1,786	486	11,713	543	13,499
Total all classes	110	3,656	624	12,867	734	16,545

NOTE.—"Passengers" includes passengers traveling on freight trains and also postal clerks, and express messengers, employees on Pullman cars, newsboys, live-stock tenders, and men in charge of freight.
*Including locomotive boiler explosions.

The very marked diminution in the number of casualties of all kinds, which continued through the last three quarterly bulletins, and which was due to the falling off in railway traffic and other well-known collateral causes, seems now to be checked. The last bulletin (No. 28) was for the April-June quarter, which always is lighter in traffic and in accidents than the other quarters of the year; and the present bulletin would therefore show casualty lists heavier than that one under ordinary circumstances; but the difference between that quarter and this is made larger, without doubt, by reason of the fact that between July 1 and October 1 the business of the country began to recover from the depression which began in October, 1907.

The totals of the present record are far smaller than in the corresponding quarter of a year ago (Bulletin 25), but in comparing Bulletin 29 with Bulletin 28 the main lesson which is to be derived from all accident statistics—the need of preventing accidents in the future—again confronts us. The number of employees killed increased 17 per cent.; employees killed in train accidents, 39 per cent.; and passengers killed from causes other than train accidents, 30 per cent.; but the increase in the number of passengers killed in train accidents was no less than 307 per cent. Nothing could more clearly enforce the lesson of the necessity of heeding the record of the causes of collisions as set forth in Table 2A, for four-fifths of the passengers killed in train accidents were the victims of collisions. Of the eight most serious collisions (Nos. 1, 2, 5, 6, 7, 8, 9, and 11), five occurred on lines where the block system

was not in use; one, No. 8, on a line where it was ostensibly in use, but was abandoned temporarily to save the time of passenger trains; and one, No. 1, on a line where it appears to have been used "permissively" for freight trains carrying passengers (drovers); leaving only one of the eight, No. 5, which appears to have been in no wise due to lack of the space-interval rules.

TABLE No. 1A.—*Comparison of Principal Items.*

	Bulletins		
	No. 29.	No. 28.	No. 25.
1. Passengers killed in train accidents.....	53	13	110
2. Passengers killed, all causes	110	57	195
3. Employees killed in train accidents.....	138	99	236
4. Employees killed in coupling.....	39	30	87
5. Employees killed, all causes	624	534	1,144
6. Total passengers and employees killed...	734	591	1,339

TABLE No. 2.—*Collisions and Derailments.*

			Persons	
	No.	Loss.	Killed.	Injured.
Collisions, rear	213	$233,733	15	500
" butting	129	203,376	55	683
" train separating	123	53,067	2	42
" miscellaneous	705	282,148	29	346
Total	1,170	$772,324	101	1,571
Derailments due to:				
Defects of roadway, etc.....	253	$165,851	11	183
Defects of equipment	621	534,213	15	205
Negligence train & sign'l men,etc	79	52,149	5	130
Unforeseen obstruct'n track, etc.	73	86,289	16	127
Malicious obstruct'n track, etc.	17	13,139	5	25
Miscellaneous causes	354	326,443	23	488
Total	1,397	$1,178,084	75	1,158
Total collisions and derailments	2,567	$1,950,408	176	2,729

Following is the usual list of Class A train accidents—all in which the damage is reported at $10,000 or over, notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest:

TABLE No. 2A.—*Causes of Twenty-three Prominent Train Accidents (Class A).*

[NOTE.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

Collisions.

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
1	R.	F. & F.	3	1	$1,860	19	Excessive speed and negligent flagging; occurred 3:40 a.m.; 3 passengers in caboose killed.
2	..	.....	4	40	3,000	29	Confusion of orders. (See note in text.)
3	M.	F. & F.	0	4	5,283	24	Train approached station 3 a.m. at uncontrollable speed. Air-brakes not properly applied; 1 angle cock closed; cause of this not discovered.
4	M.	F.	0	0	5,300	22	Train separated and rear part ran into forward part; cause of parting not discovered. Only 14 cars out of 37 cars had air-brakes working. Whole crew held at fault for failure to test brakes.
5	M.	P. & P.	7	20	5,760	5	Engineman disregarded signals at crossing. (See note in text.)
6	B.	P. & F.	3	37	6,000	28	Agent failed to deliver order; trusted an inexperienced assistant, who made only 3 copies of order when he should have made 5.
7	B.	P. & F.	20	14	11,000	52	Westbound freight encroached on time of regular eastbound passenger. Freight reached entrance to siding at meeting point at 8:01 or 8:02, one or two minutes behind passenger's time, instead of five minutes before that time, as required by rule. Men in charge of freight admitted before coroner that regulation speed from last station, as shown on time table, was not sufficient to enable them to reach the meeting point at 8 o'clock. Passenger engineman's view of road was obscured by snowstorm.
8	B.	P. & F.	5	49	12,000	2	Mistake in writing telegraphic order. (See note in text.)
9	B.	P. & F.	4	2	13,300	53	Operator accepted order after train had passed. (See note in text.)
10	R.	F. & F.	0	0	16,000	20	Excessive speed.
11	B.	P. & P.	8	59	22,297	1	Operator accepted order after train had passed. (See note in text.)
Total.....			54	226	$101,800		

Derailments.

1	D.	P.	2	2	$3,000	41	Malicious obstruction. A person was arrested and held for trial on a charge of murder.
2	D.	P.	2	0	3,200	37	Malleable-iron brake-lever jaw on tender broke, allowing rod to fall and throw wheel off track.
3	D.	P.	4	9	3,300	13	Washout, due to flood from broken reservoir.
4	D.	P.	1	16	4,900	9	Track spread; cause of spreading not determined. Rails 100 lbs. per yd., oak ties, broken stone ballast, all in first-class condition. Train consisted of 2 electric locomotives, weighing 95 tons each, and 9 cars. Line straight. Train was running at regular speed.
5	D.	F.	2	0	10,000	61	Breakage of flange of wheel of tender.
6	D.	F.	0	0	11,000	31	Broken wheel. Wheel was put under a drop test and found to be of poor material.
7	D.	P.	2	60	12,000	62*a*	Undiscovered; believed to have been fast running.
8	D.	P.	2	4	12,700	38	Worn rail on curve; curve, 5 degs.; superelevation, 4½ in.; speed, 40 miles an hour.
9	D.	F.	0	0	13,400	34	Broken truck.
10	D.	F.	0	0	14,100	18	Undiscovered; believed that a truck was broken when air brakes were suddenly applied on a deck-girder bridge 88 ft. long.
11	D.	P.	0	38	16,393	58	Maliciously misplaced switch; speed, 50 miles an hour.
12	D.	P.	2	37	20,000	35	Burning bridge; cause of fire not discovered. No person blamed.
Total.....			17	166	$123,993		
Grand total.			71	392	$225,793		

Collision No. 2, killing two passengers, was due to a confusion of orders by the conductor and motorman of an electric car (train No. 9). The case may be explained by supposing the movement of train No. 9 as eastward from A to B, C, D, E, F, and so on. Order No. 3 was issued directing train No. 9 to proceed to E. Later, order No. 5 was issued directing No. 9 to report at D; but the first order was received last and the conductor and motorman acted on it, and thus the collision occurred between D and E. Order No. 5 was received by the conductor and motorman of No. 9 at A, direct by telephone from the despatcher. Proceeding to B, they received order No. 3 from the conductor of a westbound train, to whom the despatcher had sent it at C six minutes before he sent order No. 5. The conductor and engineman of No. 9 are held negligent in not observing the sequence of numbers on the orders and in not noticing the recorded times, which showed that the order received last had been sent first. The despatcher, in sending order No. 5, did not put into it the words "instead of," and in telephoning it to the conductor and motorman of No. 9 he said nothing to them about having issued an earlier order which was to be disregarded.

Collision No. 5 occurred at a crossing where two lines, both belonging to the same railway company, cross each other diagonally. Passenger train No. 7, approaching the crossing on line B at excessive speed, was thrown off the track at the derailing switch and ran upon the ground across line A, stopping with the smoking car athwart the main track of A, in which position it was wrecked by the engine of train No. 4 on line A. Seven passengers were killed and 19 passengers and one trainman were injured. The engineman of train No. 7, who is a man of experience, appears to have been oblivious to the signals. The derailing switch was 281 ft. from the crossing and his engine ran to a point 170 ft. beyond the crossing. The signal was 50 ft. in the rear of the derailing switch and was in plain view for 885 ft. farther in the rear.

It is estimated that the speed of the train when derailed was at least 50 miles an hour, though the schedule speed of the train over that part of the line is only 22 miles an hour, the rate being limited by a city ordinance. The engineman of No. 7 "claimed" that the signal was clear when he first came within view of it, but the superintendent regards the evidence as conclusive that it was in the stop position and had been so for some time before this train came within sight of it.

Collision No. 8, causing five deaths, was due to an error in a train order. It was between an eastbound passenger train and a westbound freight. The engines and cars of both trains were badly damaged. The order as issued directed the passenger train to wait at B until "five fifteen 515 a.m." This authorized the freight to run to B if it had time to reach that point in time to properly clear the passenger train. The order as delivered to the freight read "five fifty-five 555 a.m." instead of five fifteen 515 a.m.," and the freight therefore encroached on the time of the passenger, having apparent authority to do so, to the extent of 40 minutes, and in consequence met the passenger east of B. The operator at L, who took the order for the freight, destroyed the first order she made and in place of it wrote a second copy. In making this second copy the error occurred. This operator had been in the service of the company at L four days. She had had instruction in a telegraph school twelve months and had been examined by the chief train despatcher after being under the tutelage of a station operator eleven days. It is assumed that the first order written out at L was correctly worded, as the operator had repeated it to the despatcher. Where a telegraphic order is rewritten it is the duty of the operator, under the rules, to again repeat it by telegraph to the despatcher, but this was not done. The telegraph block system is in use on the line where this collision occurred, but the block stations are far apart, and to avoid delay to the trains the block system was supplanted by a time order, as above explained. With the block system thus modified or suspended the westbound freight train, under the rules, would be required to be sidetracked at some station before the passenger train was due, and the passenger train in this case being behind time the order was issued so as to permit the freight train to go farther west before turning out.

In collision No. 9 there was negligence by both despatcher and operator. It occurred about 1.30 a.m. The operator accepted an order for the passenger train after it had passed his station. By reason of having been asleep, or otherwise negligent, he did not know whether the passenger train had passed or not, and assumed that it had; assumed that the despatcher would not offer the order to him if the train had already passed. The order was sent on Form 19, contrary to the rule, and it was acknowledged in a form applicable only to Form 31; and the despatcher did not require the operator to display his signal before taking the order; for these irregularities both men are blamed. The despatcher had ground for suspicion that the operator had not been vigilantly attending to duty and is blamed for not taking extra precautions on that account. The despatcher had had seven years' experience as such. The operator, 23 years old, had served on this road less than two months, but is said to have had several years' experience elsewhere.

Collision No. 11, causing fatal injury to five passengers, was due to the acceptance by a station operator of a train order for a train which had passed his office. Train No. 3, westbound, and No. 12, eastbound, held orders to meet at K. When No. 12 arrived at K, No. 3 being then at L, the next station east and 7 miles distant, the train despatcher undertook to change the meeting point from K to L. This order was accepted by the operator at L before he had made certain that No. 3, which had passed his train-order signal, had been held—a violation of the rule. The train despatcher then gave the order to No. 12 at K, which immediately proceeded to act upon it, and before the operator at L could reach No. 3, which was at the west end of the siding, it left there for K under the order originally given, and the trains met at a point where, by reason of the curvature, neither train could be seen from the other until they were quite close together. The operator at L is held at fault in accepting the order after the train had passed his train-order signal, and the despatcher is held at fault for giving the order to No. 12 without knowing definitely that No. 3 had been held. The services of these men had been satisfactory up to the time of this collision.

DIFFICULTIES WITH TRACK CIRCUITS IN GREAT BRITAIN.*

Numerous difficulties which are not encountered in American practice beset English railway officers in the use of track circuits, as follows:

1. The very light weight of a considerable portion of the English goods wagons. Most of these cars have a capacity of from 7 to 10 tons, though the number of wagons of 20-tons capacity is being increased.

2. The brakes on English goods wagons are seldom applied except while the vehicle is standing on a siding or being shunted in a yard, the ordinary service braking of the train being accomplished by the use of the engine brakes and the brake in the guards' van on the rear of the train. In the common type of English goods wagon the brake is applied through a long lever, the trainman generally standing upon the lever in order to apply the brake. As a rule, brakes are used on one side of the car or wagon only. This infrequent braking of goods-wagon wheels permits the formation of a sort of glaze upon the tires which is so low in conductivity that the pressure of the wheels upon the rails is hardly sufficient to reliably shunt the track-battery current of a track circuit away from its relay.

3. The use of Mansell wheels. These wheels have wooden centers, and in order to form a shunt upon the track circuit the wheel tires must be specially bonded to the axles.

4. The use of cast-iron wheels with steel tires, making poor electrical contact between the tire and the wheel center.

When the North Eastern Railway installed its automatic block system it was found that the contact between the wheel and the tire was often insufficient to secure a proper shunt, and the railway company found it necessary to bond the tires of all goods-wagon wheels to the wheel centers to secure proper electrical contact.

5. The inward canting of rails to correspond with the coning of the wheel treads.

Almost all British rail is supported in cast-iron chairs which are given such a slope as to cant the head of the rail inward at an angle to correspond with the coning of the wheel treads, which is generally one in twenty, though some roads use one in ten. This, of course, causes a larger bearing area between wheel and rail with proportionately less concentration of load, thus diminishing the probability of good electrical contact.

6. Whether from the chemical composition of English rail or from some other properties of it or from atmospheric or other conditions the rail heads in use appear to acquire a sort of film or glaze, which is a poor conductor. While the cause of this condition it not definitely known, its existence is vouched for by British signal officers of repute.

On the underground electric railways in London, including the Baker Street & Waterloo, the Great Northern, Piccadilly & Brompton, the Hampstead Tube, and the District Railway, there are over 500 automatic block signals in use, mechanical-trip automatic train stops being used in these installations. All of these roads use direct-current propulsion and the track circuit used for signaling is of the polarized, direct-current type, a factor in the use of such track circuits in connection with a direct-current propulsion system being the use of the

*From the report of Ames and Adams, Interstate Commerce Commission.

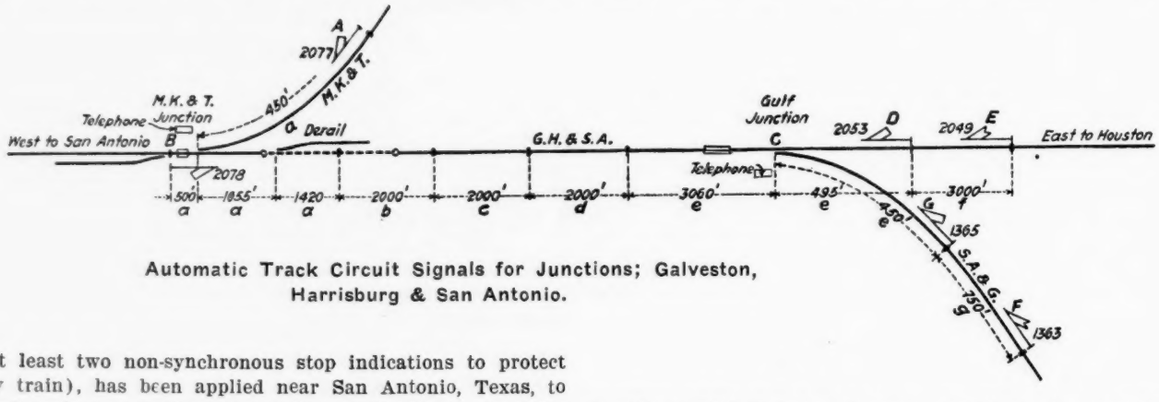
fourth rail in the track for the propulsion-return circuit, the two running rails not being used for this purpose and the third rail being used for the propulsion feeder. This arrangement is installed on account of the British Board of Trade regulation which requires that when the running rails of an electric railway are used for propulsion return the drop must be restricted to ten volts, the requirement being made in order to prevent electrolysis of water pipes and other metal conduits or structures laid underground. The electric railways in London find it cheaper to install a separate insulated return rail than to restrict the drop in the return circuit in compliance with the Board of Trade regulation.

On the Liverpool and Southport electric line of the Lancashire & Yorkshire a number of semiautomatic high semaphore signals are used, operated by solenoids, using the 600-volt current from the third rail. While they are in daily service and working reasonably well, the railway officers do not consider them a particularly desirable form of electric signal. These signals are controlled by track instruments called treadle bars, which are mounted inside the running rails in such a position as to be depressed by the wheel flanges, this movement being used for the operation of circuit controllers.

The treadle bar and other forms of track instruments are used to a considerable extent in Great Britain and on the continent in connection with controlled manual block systems and for the control of indicators and annunciators at interlocking plants, and in fact for a great many purposes where in America a track circuit would be used. There is, of course, scarcely any comparison between what can be accomplished by treadle bars as compared with track circuits, either from the standpoint of reliability or economy, under American conditions, and while, for the reasons previously stated, the use of the track circuit has met with but little favor in Great Britain, its use is increasing, and it is believed by those familiar with British signaling conditions that this increase will be considerable in the next few years.

AUTOMATIC SIGNALS FOR A JUNCTION.

The overlap principle, as used in automatic track circuit block signaling on single track, under which, when two trains are moving toward one another, each sets successive signals ahead to stop the opposing train (so that there shall always be at least two non-synchronous stop indications to protect every train), has been applied near San Antonio, Texas, to protect against each other two trains approaching a junction on converging tracks where there is no attendant. This is on the line of the Galveston, Harrisburg & San Antonio (Southern Pacific), and the scheme includes another junction attended by a switchman, with about two miles of single-track main line between them; and trains are run over this two-mile section wholly by the signals. There are no time-table rights and no written meeting orders. The problem to be dealt with was similar to that of a straight single-track line, except that the trains to be protected from running into each other were not always running in opposite directions on the same track, with an indefinite possible meeting point, but might be converging toward a definite point, the junction.



Automatic Track Circuit Signals for Junctions; Galveston, Harrisburg & San Antonio.

The situation of these junctions and the locations of the signals are shown in the drawing, which has been sent to us by General Manager Van Vleck. A part of the line governed by track circuits a and b, shown by dotted line, consists of a curve of 1½ degrees, but the rest of the main line is straight. Signals 2077 and 2078 are governed by the following track circuits; A to B; B to C; C to E, and C to F. Signal 2053 is governed by track circuits A to B; B to C; C to D, and C to F. Signal 1365 is governed by track circuits A to B; B to C; C to E, and C to G.

The way in which one train heads off another may be seen by assuming a train from the Missouri, Kansas & Texas moving toward San Antonio. On passing signal 2077 and shunting the track circuit, it sets in the stop position signals 2078, 2053, and 1365; also sets horizontal the distant signals 2049 and 1363. If a train from Houston, or from the San Antonio & Gulf, has already passed the distant signal (2049 or 1363), it will be stopped by the home signal (2053 or 1365) and must wait until the signal clears. If the signal does not clear in 20 minutes the train must flag through the block to B.

If a westbound train should pass E or F before the M. K. & T. train reached A, signal 2077 would, of course, be set in the stop position.

A train from San Antonio to Houston passing signal 2078 would set signals 2077, 2053, 2049, 1365 and 1363 against opposing trains, and such opposing trains would be stopped by 2077, 2053 or 1365. If a westbound train were to pass 2049 or 1363 before the eastbound passed 2378, it would of course set signal 2078 against the eastbound. Trains from the M. K. & T. approaching B, and from the S. A. & G. approaching C, have to be stopped before fouling the main track in order to give the front brakeman time to go ahead and set the switch.

The average number of trains each way daily over the main line between San Antonio and Gulf junction is 20; the number to and from the M. K. & T. is 8, and the number to and from the S. A. & G. is 4.

There are telephone offices at both junctions, and the despatcher keeps conductors and enginemen informed, so that when superior trains are delayed, so much as to cause delay to an inferior train, the situation will be understood and the trains moved accordingly. In the event of opposing trains meeting while flagging through the block, the westbound, according to the rule, has the preference.

Trains from the east or north are required to approach M. K. & T. junction under control, and call for a signal from the switch tender. G. H. & S. A. trains must stop clear to the junction switch, unless the switch tender gives a hand signal to proceed. M. K. & T. trains work under a similar rule. Trains from the west must approach M. K. & T. junction under control, and stop clear of the switches, unless given a proceed signal by the switch tender. M. K. & T. junction is at the entrance of the main yard at San Antonio.

General News Section.

A bill has been introduced into the legislature at Albany, N. Y., requiring railways to publish their time tables continuously "in all the newspapers."

The Missouri Pacific and the Chicago, Burlington & Quincy have arrived at a settlement of their differences regarding the crossing by the former road of the latter's tracks at St. Joseph, Mo., and the Missouri Pacific will now be able to reach its new terminal and freight house at St. Joseph, from which it has been shut out owing to its controversy with the Burlington.

George I. Roberts, 25 years old, a Wells-Fargo express messenger, has received a Carnegie medal for jumping out of his car into the San Joaquin river at Antioch, Cal., to save the life of a girl 13 years old, who was knocked off a trestle by his train—train No. 5 of the Atchison, Topeka & Santa Fe. The engineman had slackened speed, seeing two girls in danger on the trestle, but he was unable to stop until he passed them, and only one of the two succeeded in clinging to the timbers of the trestle.

Reports from the legislature of South Dakota, which is now in session, indicate that those who thought the session of 1907 exhausted the supply of brick bats suitable to throw at railways were very much mistaken in their estimate. The number of bills affecting railways which were introduced up to January 24 was 30, and the variety would do credit to a state with ten times as many aggrieved citizens as South Dakota. Mr. Simonson has introduced a bill to prohibit drinking on trains, any offender to be arrested and turned over to the police at the next station. The percentage of alcohol is not specified. Mr. Morris proposes to require electric headlights on all locomotives, and Mr. Newall has offered a full-crew law. Mr. Peterson, whose forte seems to be simplicity, would reduce all railway telegraph, express and telephone rates 25 per cent. at one stroke of the pen. Mr. Elson, evidently looking upon Mr. Simonson's prohibition of whiskey as too mild a measure, proposes to make it a misdemeanor to drink, gamble or use profane language on any passenger train. Mr. Heval would require track scales at all stations and another bill requires scales in the stock yards on which to weigh the animals.

Bergen Tunnel of the Lackawanna.

The Delaware, Lackawanna & Western opened to traffic this week its new tunnel through Jersey City Heights, N. J., thereby relieving the congestion of passenger traffic that had outgrown the old tunnel. The new tunnel is about seven-eighths of a mile long and has been blasted through solid trap rock, the easterly portal being about three-quarters of a mile west of the Hoboken passenger terminal.

Work was begun on it in March, 1906, the Grace Construction Co., New York, being the contractor. A year later the contract was annulled by mutual consent and the railway company purchased the entire equipment and assumed the work itself; the first thing done was to change the method of operating the drills from electric to compressed air power, for which change a power house was erected at the west end.

The tunnel is of the most modern construction. There are two openings, each 85 x 100 ft., extending 80 ft. to the surface and walled with 18 in. of concrete. There are two ventilators as well, which, with the larger openings, keep it practically clear of smoke and gas. The entire bore is lined with a foot thickness of concrete, and drain pipes have been supplied at regular distances along the side walls embedded in the concrete to allow the water from the rock to flow away without damaging the masonry. The pipes carrying wires have been embedded beneath each track and there are bolts in the ceiling above to provide for the future when electricity may become the motive power for train operation.

In carrying the two tracks to the east portal of the tunnel, it was necessary to fill in 25 ft. south of the original tracks and a distance of 300 ft. west to the West Shore Railroad, over which and Hoboken avenue two steel bridges have been built. At the west end, a heavy trestle bridge has been built to carry the tracks over those of the Erie Railroad. The old signal houses at either end of the old tunnel have been abandoned. The electro-pneumatic interlocking at the east is controlled from a concrete tower west of Grove street, Jersey City, and the interlocking at the other end is handled from a temporary wooden tower.

All eastbound traffic goes over the two tracks of the new tunnel, while the old tunnel carries the westbound traffic. The Lackawanna's local, or commutation travel, has increased 30 per cent. in nine years, covering a distance of about 40 miles, and 30,000 people are carried daily in each direction in and out of Hoboken.

Joint Interchange and Inspection at Peoria, Ill.

A committee of mechanical and transportation officers of the railways at Peoria, Ill., has prepared a report favoring the establishment of a joint interchange and inspection bureau at that city. The committee found that in January, 1909, the number of cars interchanged at Peoria averaged 974 per day and that inspecting and reporting them cost during the month $6,216. The committee believes that a manager of the proposed joint interchange and inspection bureau and joint assistant managers, clerks, inspectors, etc., could be employed at $3,840 per month. There would be also offices, lights, telephones, etc., to be paid for, costing about $100 per month, and the first expense of equipment of the necessary offices, which is estimated at $600. On this basis it will be seen that there would be a net saving per month of about $2,000. The committee believes also that better records would be kept and the movement of cars would be more satisfactory. The members of the committee were A. L. Rossetter, R. R. Harris, T. J. Haynes, T. N. Kucher, E. R. Bissell, E. Raymond, D. C. Frederick, B. C. Cooper and E. R. Taylor.

Reports from California, Oregon and other parts of the West and Northwest indicate that the railways have suffered severely from storms during the past few weeks. The Southern Pacific lines have had more trouble in maintaining service over some of their lines in California than in any past time in years. There were several days of heavy snow. This was followed in California by heavy downpours of rain, which melted the snow; and the floods that resulted did much damage to roadway both by washing it out and by causing slides of earth and rock. Some important bridges were much damaged. Trains in the Northwest have been operated under great difficulties. Slow orders on account of bad track have caused passenger trains to be run much behind schedule and freight trains have been run with much irregularity.

For Passengers to Paste in Their Hats.

The traveler seated on the observation platform at the rear of a modern passenger train finds fascinating occupation in watching the silent monitors of the track. From his comfortable seat he notes as he passes that the signal covering the track on which his train is running is set at the stop position and remains there till long after it has gone out of sight, no matter how long the tangent. He knows that before his train has left the zone protected by that signal it has entered another and that the semaphore arm, responding to the impulse of the locomotive, has risen to the horizontal position, thus extending its absolute authority over that block of track. If the road happens to be double-track he may occasionally see the signal set on the opposite track, warning of the approach of another train, and he will also have the opportunity of watching the signal return to the clear position after the train has passed to another block. If it be a piece of single track he will notice that the signals on the right-hand side of the track remain at the danger position after his train has passed, while those on

the left-hand side drop back to clear. This shows him that the track is blocked for trains proceeding in the same direction as his, but is cleared the other way. The protection in this case is afforded by the fact that as soon as the train leaves the block that clears the track for a train going in the opposite direction it sets the signal ahead, so that it is protected by the block at either end. This arrangement not only guards against rear-end, but also head-on, collisions. At night the lights are as interesting to watch as the semaphore arms by day and the signals never fail to attract attention.—*Union Pacific officer, in Omaha Bee.*

Washington Letter.

Washington, Feb. 17.—Three bills affecting railways were passed by the House this week, and two of them are understood to have more than a good chance to become law. The three are known as the Safety Appliance Bill, the Bill to Enlarge the Interstate Commerce Commission, and the Bill for the Destruction of Useless Railway Documents.

The Safety Appliance measure was passed under pressure on Monday despite the protests of members who asked that it go over until the House could have opportunity to examine it. But although the hearings of the committee on the bill had not yet been printed and no member outside of those belonging on the Committee on Interstate and Foreign Commerce had had an opportunity to read them, and in spite of the objections of leaders of organizations of railway employees, the bill was railroaded through the House under charge that those who voted against it would be responsible for the maiming of railway employees. The bill provides that from July 1, 1910, the compulsory uniform safety appliance law shall include not only couplers and power brakes but also sill steps and hand brakes, running boards and hand holds or grab irons on the roofs. The Interstate Commerce Commission shall designate the number, dimensions, location and manner of application of the appliances, and thereafter said number, location, dimensions and manner of application shall remain as the standards of equipment to be used on all cars subject to the provisions of the Federal law, unless changed by an order of the Commission. The bill is not expected to pass the Senate, but its promoters in the House will have made it serve their purpose by passing the responsibility for its defeat to the Senate.

The bill to enlarge the Interstate Commerce Commission from seven members to nine does not appear to have had any particular opposition. All who spoke seemed to believe that the Commission is undertaking too much work, and that this bill will enable it to dispose of its work faster. Of course if Mr. Taft's ideas prevail, a year or two hence, a commission of nine may not be needed, but the claim is that the present emergency is so great that Congress should wait no longer before giving the Commission assistance to carry on its work. The gossips say that a chief purpose of the bill is to provide a place for Representative Hepburn when his term as Congressman expires. It is understood that the Commission itself does not want the measure passed. In the upper chamber Senator La Follette, who is the leading rate regulator in Congress, believes it would be unwise to pass it. He agrees with the Commission that the effect of the measure will be to impede progress by rendering the Commission unwieldy. Conservatives in the Senate are no more friendly to the bill than is Mr. La Follette. With the congestion of business now existing, Senators believe that nothing can be done at the current session, but that the bill will probably be run through the lower chamber again at the special session and will then be used as the basis for a railway debate in the Senate.

The bill for the destruction of useless railway papers is coupled with a provision for the punishment of any person who wilfully falsifies railway accounts, and it is regarded as a meritorious bill. Many railways have been annoyed and put to expense through the operation of the present law, which virtually forbids the destruction of any records of whatever nature. In many instances roads have been compelled to rent warehouse space for the storage of obsolete papers. This bill, which passed without amendment, re-enacts the provision for the punishment of any person who shall wilfully make any false entry in any record or memoranda, or who shall wilfully destroy, mutilate, alter, etc., and adds the proviso that "the commission may in its discretion issue orders specifying such operating, accounting or financial papers, records, books, blanks, tickets, stubs or documents of carriers which may, after a reasonable time, be destroyed, and prescribing the length of time such books, papers or documents shall be preserved."

Vagrants on the Pennsylvania.

Reports just compiled by the Pennsylvania Railroad show that during the year 1908 657 trespassers were killed and 791 injured on the lines of the Pennsylvania system east and west of Pittsburgh. In 1907 822 trespassers were killed. These figures emphasize the recommendation in the recent annual reports of the state railroad commissions of Pennsylvania and Indiana that laws should be enacted providing substantial punishment for all persons who trespass on the rights of way of railways.

President McCrea, of the Pennsylvania, writing to O. F. Lewis, of the Charity Organization Society of New York, says that his company has been unable to develop co-operation by the towns and cities along its lines in prosecuting and convicting trespassers and vagrants. The number of arrests has increased to such an extent that many city and town authorities are unable at times to take care of the trespassers sentenced to their penal institutions for confinement. It is the same old story of shirking and neglect. Mr. McCrea says: "County authorities will assert that a vagrant be permitted to move from one county to another before being arrested, and the county in which the arrest is made charged with the maintenance of the prisoner. County authorities and their constituents object to the expense entailed in the maintenance of these people. When vagrants are arrested and incarcerated in county jails it is seldom that any record is taken of them, and when they are released and again incarcerated in the jail of another county the latter county has no record showing former incarcerations. With co-operation the records of vagrants would be accessible to all county authorities, and confirmed tramps could be singled out and given adequate punishment."

During the year 1908 2,989 persons were arrested for trespassing, 442 for vagrancy and 10,457 for illegal train-riding on the lines of the Pennsylvania system.

Railway Appliances Exhibition at Chicago, March 15-20.

An exhibition of all sorts of appliances used in the construction, maintenance or operation of railways will be held on a large scale at the Coliseum, Chicago, throughout the week of March 15-20. The appliances exhibited will be full size, and many of them will be in operation.

For a number of years the Road and Track Supply Association has had a small exhibit of models and drawings of these appliances in the parlors of the Auditorium during the annual meeting of the American Railway Engineering and Maintenance of Way Association, but as railway officers naturally would prefer to see the devices themselves, it was decided to give an exhibit that would afford them this opportunity and would comport with the size and importance of the association.

The Coliseum, chosen for the purpose, has on the main floor 45,317 sq. ft., of which 32,517 sq. ft. will be devoted to exhibits and 12,800 sq. ft. to aisles. In addition to this there will be the Annex to the Coliseum, which contains 9,582 sq. ft., 6,138 sq. ft. being devoted to exhibits and 3,444 to aisles.

This will be the largest and most complete exhibit of materials for the engineering department that has ever been held in this country. Large numbers of railway officers will no doubt attend, as it will be an unusual opportunity to see improvements in which they are interested.

The manufacturers' appreciation of this opportunity is evidenced by the large spaces that some of them have taken. Two firms have secured upwards of 1,500 sq. ft. each and several 1,000 sq. ft. each.

There are only a few spaces now left. These can be secured by writing to John N. Reynolds, Secretary-Treasurer of the Road and Track Supply Association, 160 Harrison street, Chicago.

Western Railway Club.

The monthly meeting of the Western Railway Club was held at the Auditorium Hotel, Chicago, on February 16. The paper of the meeting was by R. B. Dole, Assistant Chemist of the Water Resources branch of the United States Geological Survey, and was entitled "The Quality of Surface Waters in the Northern Central Cities." The paper dealt with analyses that have been made of the waters in the section through which the railways entering Chicago run. It was illustrated by stereopticon views.

American Society of Civil Engineers.

At the meeting held on February 17 a paper by R. P. Bolton, M. Am. Soc. C. E., entitled "The Operation of Passenger Elevators," was presented for discussion.

Canadian Society of Civil Engineers.

At a sectional meeting held on February 18, a paper entitled "Modern Fireproof Construction: Facts and Figures," by W. N. Moorhouse, was read, and illustrated with lantern slides.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; May 11-14, 1909; Richmond, Va.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; May 11; St. Louis, Mo.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th street, New York; second Friday in month; New York.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Pl., New York, May 19, 1909; New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M., Concord, N. H.; Oct. 19, 1909; Jacksonville, Fla.

AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, Monadnock Bldg., Chicago; March 16-18, 1909; Chicago.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 16-18, 1909; Atlantic City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and Aug.; New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., N.Y.; 2d Tues. in month; annual, Dec. 7-10; New York.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 W. 39th St., New York.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 28, 1909; Cincinnati.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—E. H. Hemus, A., T. & S. F., Topeka, Kan.; last week in May, 1909; Detroit, Mich.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS—P. W. Drew, Wisconsin Central Ry., Chicago; June 23-25, 1909; Detroit.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York; June 22-23; Montreal.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.; June 16, 1909; Old Point Comfort, Va.

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 62 Liberty St., N. Y.; Apr. 27-30, 1909; Louisville, Ky.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; June 21-23, 1909; Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—E. C. Cook, Royal Insurance Bldg., Chicago; June 1-5; Chicago.

IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 21-23, 1909; Atlantic City.

NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in mnth, ex. June, July, Aug. and Sept.; Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.

NORTH-WEST RAILWAY CLUB.—T. W. Flannagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, Aug.; St. Paul and Minn.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June July and August; Pittsburgh.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.; March 15, 1909; Chicago.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.; May 17-19; Chicago.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Nov., 1909; Washington.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. 2d Friday in month, except June, July and Aug.; St. Louis.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—J. H. O'Donnell, Bogalusa, La.; April 15; Atlanta, Ga.

SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., April, Aug. and Nov.; Atlanta.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.; September, 1909; Denver.

WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

Traffic News.

The Oklahoma Corporation Commission will hold a hearing February 15 on a proposed order revising the rules governing the consignment of freight, car service, etc.

The Transcontinental Passenger Association at its next meeting, which will be held in Seattle, Wash., in June, will consider the question of a general increase in baggage-car rates to Pacific coast points.

A bureau has been created in the office of E. D. Levy, Superintendent of Transportation of the St. Louis & San Francisco, to have charge of the handling of all freight carried in ventilated cars or requiring any artificial temperature.

The Georgia Railroad Commission has refused to permit the Central of Georgia to increase its passenger fares from 2¼ cents a mile to 2½ cents; and has denied the application of the road for leave to take off certain trains on the Macon and Washington branches.

Beginning April 1, a stop-over of ten days will be allowed at Cincinnati to passengers holding through tickets. A similar rule has been adopted for Buffalo on westbound business and is under consideration with respect to eastbound business. Exchange street, Buffalo, which formerly swarmed with ticket brokers now has only two.

The executive committee of the Western Passenger Association has recommended to the Association that a ten-day stop-over privilege be granted on all first-class round-trip tickets reading through Chicago. The roads interested have recently voted to grant this privilege at St. Louis, Pittsburgh, Cleveland, Buffalo and Kansas City.

The executive committee of the Western Passenger Association has adopted a recommendation that passengers buying tickets from western points to eastern ports no longer be allowed to check their baggage through to steamship docks. The reason given is that the steamship companies refuse to advance the charges on baggage delivered to them; and as the transfer companies at the ports often find it impossible to find the owners of baggage, they frequently are unable to collect the transfer charge.

The Chicago Coal Dealers' Association, the Pennsylvania Retail Coal Dealers' Association, and the Michigan, Indiana and Wisconsin Retail Coal Dealers' Associations have all adopted resolutions asking the railways to accept payment for the transportation of freight upon the basis of the weight of the coal as ascertained at destination. At present mine weights govern, and the retail dealers claim that they are constantly subject to loss because the coal weighs less at destination than the mine weights show.

Passenger train No. 4 of the Denver & Rio Grande was held up at 3.15 a.m. of February 13, at Military Junction, between Fort Logan and Denver, by two bandits, who suddenly appeared from the tender and compelled the engineer and fireman to stop the train. The bandits compelled the fireman to call out to the mail clerks to open the door and one of the robbers forced the fireman to help him put three sacks of registered mail into one large mail sack. This he threw out of the car. The robbers then marched their prisoners ahead of the train and made good their escape.

The Great Southwestern Express Company, with a capital stock of $300,000, has been organized in New York to do business in Texas. J. A. Russ, formerly with the Pacific Express Company, will, it is stated, be Manager of the new company. The new company proposes to establish offices throughout Texas and to seek to compel the railways, under a state law which has long been dormant, to carry the company's business, even though contracts exist with other express companies. The law in question was passed in 1887, and requires every railway in the state to furnish reasonable and equal facilities at reasonable and equal rates to all corporations and persons engaged in the express business.

The meeting held in New York this week to consider rates on coal and coke from the Virginias, Ohio and western Pennsylvania to lake ports reached no result. The participants were the representatives of the Western Pennsylvania and

Eastern Ohio Railway Traffic Association, the Ohio Coal Traffic Association and the chief traffic officers of the West Virginia coal carrying roads. There is some friction because, it is claimed, West Virginia operators pay 40 per cent. less for mining coal than do those of Ohio and western Pennsylvania, and at the same time enjoy the advantage of a much lower railway rate to competitive points. It is said that West Virginia operators have been making serious inroads in the trade territory of the Ohio and western Pennsylvania operators.

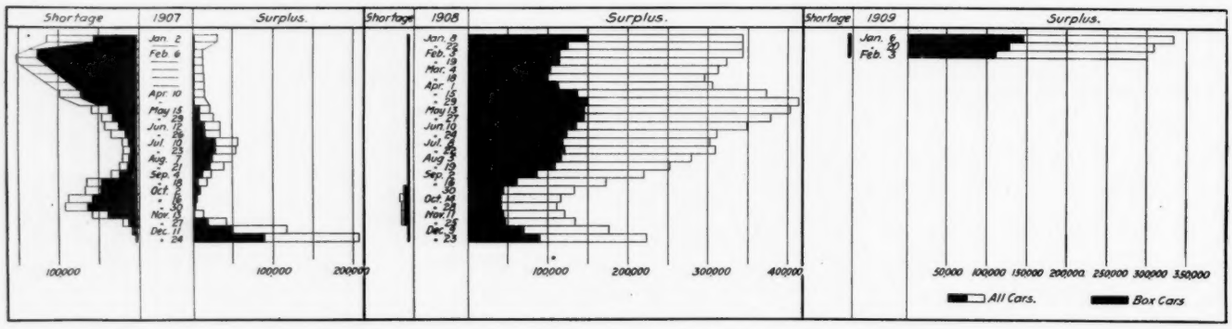
The freight traffic committee of the Chicago Association of Commerce and H. C. Barlow, Traffic Director of the Association, are co-operating with the railways in a campaign to reduce loss and damage to freight. The Association is distributing several thousand copies of a pamphlet entitled "Why Freight Is Lost or Damaged," which was written by A. C. Kenly, Superintendent of Freight of the Atlantic Coast Line, and was originally published under the auspices of the General Managers' Association of the Southeast. It both tells how to mark and pack freight and how not to mark and pack it, and is copiously illustrated with photographs of actual packages which were well or ill packed and which show the results of the kind of packing that they received. The Association of Commerce proposes to persist in its campaign to educate shippers on this subject, with the expectation that losses of shippers through loss and damage will be reduced and the amount of contention and friction between them and the railways due to this cause will grow less.

Car Surpluses and Shortages.

Arthur Hale, Chairman of the Committee on Car Efficiency of the American Railway Association, in presenting bulletin No. 41 giving a summary of car surpluses and shortages by groups from December 24, 1907, to February 3, 1909, says:

"The report for this period shows a decrease in the surplus of 10,093 cars, leaving a total of 301,571. The largest decrease was in box cars, the total number of this class restored to service being 16,572. Unfavorable conditions in the coal trade seem to have continued, resulting in an increase of 6,031 coal and gondola cars. There was practically no change in the number of bad order cars."

The accompanying table gives the car surpluses and shortages for the period covered by the report, and the chart shows surpluses and shortages in 1907, 1908 and 1909.



Car Surpluses and Shortages in 1907, 1908, 1909.

INTERSTATE COMMERCE COMMISSION.

When carriers have of their own volition made a reduction in rates, it is not the practice of the Commission to award reparation as a matter of course on all shipments made previous to the reduction. Such a policy would operate as the strongest possible deterrent to the voluntary decrease of rates.

The unreasonableness of a through rate on an interstate shipment via a given route cannot be determined, in the absence of other evidence, by a mere comparison therewith of a lower aggregate of rates consisting of a local intrastate rate plus an independent interstate rate based on a junction through which the carriers have no joint route and no basis of division.

In complaints for recovery of damages caused by unreasonable or unduly discriminatory rates, the cause of action accrues when the payment is made; in any other complaints for recovery of damages for alleged violations of the act to regulate commerce of which this Commission has jurisdiction, the cause of action accrues when the carrier does the unlawful act or fails to do what the law requires.

Responsibility for Misrouting.

Washington Broom & Woodenware Co. v. Chicago, Rock Island & Pacific. Opinion by Commissioner Harlan.

In this case the defendants alone were responsible for the misrouting of the shipment in question through a junction carrying a higher rate than was available through another junction, and must therefore bear the entire burden of the mistake; and the connecting carriers participating in the movement, being without fault, cannot be required to join in the payment of the damages to which the complainant is entitled.

The privileges embodied in a separate storage and reconsignment tariff issued by one carrier cannot be availed of, or applied to movements, under a joint tariff to which that carrier and two others are named as parties, unless the latter tariff by express reference to the former so provides.

CAR SURPLUSES AND SHORTAGES, FROM DECEMBER 24, 1907, TO FEBRUARY 3, 1909, INCLUSIVE.

		Surpluses.					Shortages				
Date.	Number of roads.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
February 3, 1909	165	110,632	26,121	122,711	42,107	301,571	97	31	49	111	288
January 20, 1909	162	127,104	26,723	116,180	41,057	311,664	163	21	139	35	358
January 6, 1909	156	146,255	25,383	117,686	43,695	333,019	170	202	120	14	506
December 23, 1908	158	87,350	16,247	79,595	38,885	222,077	471	42	289	217	1,019
December 9, 1908	161	67,550	15,336	58,816	33,941	175,643	1,134	73	276	196	1,679
November 25, 1908	160	45,194	12,157	43,854	31,624	132,829	7,923	178	900	209	9,210
October 28, 1908	158	39,383	10,185	31,541	29,803	110,912	8,175	167	2,261	236	10,839
September 30, 1908	160	42,593	10,365	49,795	31,039	133,792	7,313	450	224	127	8,114
August 19, 1908	160	106,367	13,494	92,500	40,642	253,003	465	90	105	194	854
July 22, 1908	166	120,580	14,401	125,739	47,960	308,680	115	37	330	27	509
June 24, 1908	163	123,112	18,042	130,149	41,995	313,298	266	34	120	31	451
May 27, 1908	160	144,697	20,075	162,695	54,437	381,904	82	13	12	18	125
April 29, 1908	159	147,971	24,350	186,742	59,542	418,605	145	42	16	64	267
March 18, 1908	160	103,509	25,122	119,205	49,206	297,042	533	151	250	73	1,007
February 19, 1908	161	113,776	30,088	134,217	44,432	322,513	697	141	249	162	1,249
January 22, 1908	161	124,622	27,328	142,388	48,292	342,580	392	132	79	135	738
December 24, 1907	158	87,714	14,740	64,556	42,300	209,310	187	81	191	265	724

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF DECEMBER, 1908.
(See also issues of February 5 and 12.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with 1907.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama Great Southern	309	$199,961	$88,323	$319,865	$49,229	$57,451	$7,629	$106,592	$7,747	$228,648	$91,217	$916*	$11,489	$78,812	$48,253
Atlanta, Birmingham & Atlantic	642	147,786	44,555	203,984	22,857	37,916	11,501	80,417	9,614	162,305	41,679	.....	7,500	34,179	3,302
Baltimore & Ohio	3,992	4,629,499	991,413	6,012,241	640,298	885,751	125,372	2,242,120	124,044	4,017,585	1,994,656	41,455*	173,635	1,779,566	890,319
Charleston & Western Carolina	340	98,126	27,444	132,185	25,303	13,128	2,799	44,933	3,337	89,500	42,685	.....	4,100	38,585	§9,850
Chicago & Erie	270	271,937	62,666	367,376	23,724	71,309	12,985	181,251	8,591	297,860	69,516	110	11,083	58,543	75,472
Chicago, Rock Island & Gulf	493	238,760	63,598	315,120	57,914	21,540	6,101	108,108	9,419	203,082	112,038	259*	858†	112,637	§3,067
Cincinnati, Hamilton & Dayton	1,036	457,968	126,222	717,985	71,710	127,439	20,952	346,441	27,215	593,757	124,228	14,468*	25,000	84,760	131,022
Cincinnati, New Orleans & Texas Pac.	337	479,585	130,093	644,946	49,905	119,651	17,471	207,429	17,685	412,141	232,805	1,132*	19,642	212,031	123,760
Cleveland, Cincinnati, Chic. & St. L.	1,982	1,475,721	559,589	2,253,287	247,301	605,189	64,712	918,189	51,446	1,886,837	366,450	5,356*	100,227	260,867	262,221
Denver & Rio Grande	2,552	1,322,912	317,387	1,717,789	124,503	338,158	36,528	647,722	53,862	1,200,773	517,016	382*	65,000	451,634	§130,502
Duluth, Missabe & Northern	246	54,486	31,661	89,920	47,867	67,353	1,392	53,125	23,752	193,489	103,569*	6,933*	5,146	115,648‡	80,602
Evansville & Terre Haute	310	111,810	48,797	177,616	26,222	24,271	3,923	59,580	6,526	120,522	57,094	301*	9,035	47,758	10,437
Georgia R. R.	307	162,899	68,980	246,488	49,002	30,694	8,287	98,165	10,119	196,267	50,222	.....	2,490	47,732	27,536
Georgia Southern & Florida	395	106,734	57,592	185,889	22,354	33,004	4,698	64,882	8,360	133,298	52,591	1,585	9,837	44,339	9,071
International & Great Northern	1,160	583,106	163,756	794,426	133,976	112,677	17,127	299,610	20,493	583,883	210,543	.....	23,000	187,543	107,153
Iowa Central	558	207,464	43,357	262,635	16,678	50,433	9,790	122,345	8,631	207,877	54,758	.....	7,345	47,413	§39,691
Lake Erie & Western	724	289,107	57,813	366,723	47,653	67,994	8,660	150,704	10,424	285,435	81,288	.....	17,380	63,908	105,948
Lake Shore & Michigan Southern	1,508	2,320,903	776,589	3,531,307	300,566	479,464	114,787	1,205,094	63,309	2,163,220	1,368,087	4,861*	223,646	1,139,580	533,275
Louisiana Ry. & Navigation Co.	343	86,933	13,837	106,090	22,654	7,903	3,279	41,377	5,577	80,790	25,300	.....	3,750	21,550	25,220
Michigan Central	1,746	1,412,911	494,176	2,099,350	195,578	329,750	80,271	829,626	37,057	1,472,282	627,068	14,867*	94,694	517,507	29,740
Minneapolis & St. Louis	1,027	260,386	82,612	368,927	21,416	57,754	10,639	139,864	11,737	241,410	127,517	54*	15,342	112,121	20,998
Mobile, Jackson & Kansas City	403	117,529	32,746	159,016	21,534	16,706	1,623	44,716	9,897	94,476	64,540	.....	6,135	58,405	26,106
Morgan's La. & Tex. R. R. & S. S. Co.	351	429,225	101,113	564,211	82,862	41,365	5,691	171,718	13,239	314,875	249,336	9,342	22,614	236,064	§17,750
New York Central & Hudson River	3,588	4,421,887	1,986,836	7,208,746	724,002	1,442,945	202,730	2,892,677	143,097	5,405,451	1,803,295	41,410	586,529	1,258,176	171,552
Northwestern Pacific	373	83,779	103,214	205,513	41,504	37,818	2,496	89,541	9,696	181,055	24,458	.....	8,955	15,503	35,715
Oregon R. R. & Navigation	1,264	722,959	261,317	1,043,759	87,058	75,989	23,015	295,206	32,929	514,197	529,562	4,838*	50,953	473,771	§212,918
Peoria & Eastern	352	173,384	57,748	250,395	30,539	42,340	4,642	97,925	4,792	180,238	70,157	.....	11,888	58,269	14,301
Rutland	468	113,942	71,710	212,099	41,611	32,034	5,659	89,789	7,095	176,188	35,911	.....	8,649	27,262	22,122
St. Louis Southwestern	773	496,525	131,597	654,513	108,094	97,639	25,856	145,455	21,170	398,214	256,299	637*	15,025	240,637	83,235
St. Louis Southwestern of Texas	697	239,281	92,035	354,480	97,363	66,689	8,146	139,988	16,631	328,817	25,663	173*	4,050	21,440	55,912
Santa Fe, Prescott & Phoenix	257	83,695	24,955	115,710	16,506	11,155	2,423	28,594	5,429	64,107	51,603	.....	.....	51,603	7,599
Seaboard Air Line	2,611	997,952	333,561	1,464,500	175,480	193,576	49,174	512,025	47,657	977,912	486,588	1,383*	50,500	434,705	272,617
Southern Pacific—Pacific System	5,586	4,169,849	2,175,994	6,817,301	679,467	945,816	133,896	1,854,876	241,615	3,855,670	2,961,631	12,103*	245,503	2,704,025	399,748
Texas Central	268	80,967	44,555	132,862	18,322	14,418	1,014	38,825	4,780	77,359	55,503	.....	1,969	53,534	337
Toledo & Ohio Central	441	222,634	41,683	275,560	44,587	48,113	4,599	123,274	5,856	226,429	49,131	3,291*	14,247	31,593	§9,546
Wabash	2,515	1,427,362	524,335	2,139,273	212,583	340,110	64,083	870,607	60,746	1,548,129	591,144	2,388*	63,255	525,501	111,983
SIX MONTH OF FISCAL YEAR.															
Alabama Great Southern	309	$1,134,160	$508,556	$1,814,649	$242,636	$356,688	$44,897	$599,973	$50,979	$1,295,173	$519,476	$4,473*	$68,817	$446,186	$141,070
Atlanta, Birmingham & Atlantic	642	708,664	245,229	1,010,556	118,432	174,049	51,777	365,913	38,545	748,716	261,840	.....	39,000	222,840	43,417
Baltimore & Ohio	3,992	28,001,513	6,856,557	36,964,881	4,372,136	5,295,010	786,141	12,450,386	720,393	23,624,066	13,340,815	256,034*	1,019,485	12,065,296	246,048
Charleston & Western Carolina	340	505,487	143,049	693,770	138,998	88,129	14,670	257,061	19,622	518,480	175,290	.....	24,600	150,690	22,454
Chicago & Erie	270	1,580,570	407,747	2,160,004	223,878	494,020	68,594	999,263	45,689	1,831,444	328,560	1,600	68,080	262,080	112,968
Chicago, Rock Island & Gulf	493	1,055,060	377,543	1,508,595	367,925	124,472	36,662	567,509	51,770	1,148,338	360,257	1,206*	16,033	343,018	§37,363
Cincinnati, Hamilton & Dayton	1,036	2,909,876	913,393	4,249,864	491,622	787,619	131,683	1,743,667	125,921	3,280,512	969,352	.....	150,393	818,959	213,059
Cincinnati, New Orleans & Texas Pac.	337	2,955,674	732,066	3,888,104	432,497	783,628	98,421	1,180,557	103,929	2,599,032	1,289,072	9,957*	117,852	1,161,263	300,962
Cleveland, Cincinnati, Chic. & St. L.	1,982	8,439,523	3,723,154	13,441,907	1,544,298	2,315,162	420,589	5,199,270	260,596	9,739,915	3,701,992	13,999*	411,348	8,276,645	105,131
Denver & Rio Grande	2,552	7,718,761	2,745,601	10,958,756	1,246,355	1,712,547	235,191	3,617,416	313,053	7,124,562	3,834,194	37,875	389,750	3,482,319	§569,907
Duluth, Missabe & Northern	246	6,456,614	180,585	6,667,536	475,899	512,413	7,249	797,168	76,869	1,869,598	4,797,938	39,931	270,550	4,567,319	§519,535
Evansville & Terre Haute	310	707,382	310,717	1,129,569	167,030	145,018	21,776	338,086	37,817	709,727	419,842	1,726*	54,210	363,906	7,746
Georgia R. R.	307	999,668	392,232	1,479,249	311,135	204,259	49,497	599,417	44,025	1,208,333	270,916	.....	10,615	260,301	§25,363
Georgia Southern & Florida	395	539,537	307,219	960,437	78,588	171,651	29,791	350,970	52,019	683,020	277,417	8,758	49,994	236,181	83,192
International & Great Northern	1,160	3,172,461	912,473	4,352,753	666,584	939,394	92,123	1,639,761	122,433	3,160,295	1,192,458	.....	138,000	1,054,458	801,371
Iowa Central	558	1,179,712	282,641	1,535,094	143,645	267,952	53,265	659,578	51,563	1,176,003	359,091	.....	44,377	314,714	§212,193
Lake Erie & Western	724	1,717,470	443,201	2,279,497	328,510	409,476	65,993	864,308	60,948	1,729,235	550,262	.....	102,761	447,501	§51,446
Lake Shore & Michigan Southern	1,508	13,547,231	5,092,282	21,240,351	2,684,773	2,922,176	508,901	6,525,339	341,103	12,982,292	8,258,059	11,699*	773,647	7,472,713	§19,096
Louisiana Ry. & Navigation Co.	343	406,992	65,763	511,870	141,149	66,562	18,264	224,386	30,343	480,704	31,166	.....	19,500	11,666	61,544
Michigan Central	1,746	8,331,742	3,428,675	12,891,230	1,620,627	1,710,890	366,520	4,823,710	209,352	8,731,099	4,160,131	19,856*	565,694	3,574,581	§721,718
Minneapolis & St. Louis	1,027	1,518,978	611,004	2,277,988	208,276	274,866	59,450	779,608	72,484	1,394,684	883,304	95*	92,304	790,905	61,497
Mobile, Jackson & Kansas City	403	571,445	160,006	780,869	118,639	91,162	9,513	247,191	51,944	518,449	262,420	.....	20,603	241,817	99,577
Morgan's La. & Tex. R. R. & S. S. Co.	351	1,831,562	510,860	2,492,254	423,824	256,755	47,987	899,347	73,305	1,701,218	791,036	7,861	97,115	701,782	247,692
New York Central & Hudson River	3,588	25,877,067	14,712,380	45,196,653	5,658,700	7,618,374	1,089,888	16,092,210	945,887	31,405,059	13,791,594	139,171	2,357,676	11,573,089	18,809
Northwestern Pacific	373	682,358	897,809	1,702,709	351,596	219,691	13,765	568,512	55,665	1,209,229	493,480	.....	54,830	438,650	§33,761
Oregon R. R. & Navigation	1,264	4,898,973	1,841,715	7,125,074	730,788	448,362	124,300	1,802,759	172,674	3,278,883	3,846,191	5,070*	261,761	3,579,360	§145,497
Peoria & Eastern	352	978,108	366,745	1,466,464	189,504	214,354	30,485	551,296	26,913	1,012,552	453,912	.....	53,812	400,100	§16,392
Rutland	468	791,883	575,329	1,525,861	222,353	190,992	37,104	565,910	35,389	1,051,748	474,113	.....	56,663	417,450	77,446
St. Louis Southwestern	773	2,732,933	622,013	3,498,951	445,114	562,201	126,726	844,116	118,879	2,097,036	1,401,915	3,362*	90,150	1,308,403	§41,046
St. Louis Southwestern of Texas	697	1,400,538	498,511	2,031,864	489,492	395,686	50,025	835,282	92,181	1,862,666	169,198	1,314*	49,884	118,000	86,549
Santa Fe, Prescott & Phoenix	257	470,141	158,755	670,012	112,472	57,070	13,920	157,971	28,184	369,617	300,395	.....	.....	300,395	§58,963
Seaboard Air Line	2,611	5,391,403	1,663,866	7,785,678	1,157,572	1,137,988	274,689	2,754,923	287,012	5,612,184	2,173,494	9,037*	303,000	1,861,457	319,778
Southern Pacific—Pacific System	5,586	25,951,503	13,513,252	42,173,961	5,034,260	5,127,922	671,343	11,036,065	1,191,764	23,061,354	19,112,607	40,594*	1,378,666	17,693,347	2,380,684
Texas Central	268	392,856	226,504	656,978	77,886	82,984	5,973	224,528	25,104	416,475	240,503	.....	11,954	228,549	4,168
Toledo & Ohio Central	441	2,052,671	343,073	2,473,167	337,377	365,905	33,604	754,224	33,099	1,524,209	948,958	21,252	83,997	886,213	112,723
Wabash	2,515	8,768,786	3,525,950	13,359,183	1,476,961	1,935,649	397,622	4,981,882	382,751	9,174,865	4,184,318	6,236*	407,785	3,770,297	§363,311

*Deficit. †Credit. ‡Loss. § Decrease.

COURT NEWS.

The Adams Express Company, having obtained an injunction in the Federal court restraining the Indiana Railway Commission from fixing certain rates for express companies, two trials were held. The court ruled against the Commission and the orders were withdrawn.

The hearings in the government's suit against the coal carrying roads have been indefinitely postponed because of a disagreement between the counsel for the government and counsel for the Philadelphia & Reading, over the authority of Examiner Guilbert to pass on the evidence.

The hearings held by order of the court to secure testimony in the suit of the government against the Union and Southern Pacific (held last month in New York and later in Pittsburgh) were continued last week at Cincinnati. Many witnesses were called to testify that the two roads maintained their soliciting agencies jointly, indicating an absence of competition.

The United States Circuit Court of Appeals at Chicago on February 11 reversed a decision in the United States District Court, Judge Bethea, in which the Atchison, Topeka & Santa Fe was convicted and fined for alleged violation of the federal safety appliance law. The chief reason for reversing the lower court was that the Circuit Court of Appeals believed that Judge Bethea erred in directing peremptorily a verdict against the railway.

Judge Edward R. Meek, of the Federal court, on February 8 issued an injunction perpetually restraining the Railroad Commission and the Attorney-General of Texas from enforcing against the Pullman Company an order issued by the Railroad Commission on February 1, 1907, requiring a reduction of 20 per cent. in sleeping car rates in the state. The railways over whose lines the Pullman Company operates are also restrained from obeying any order by the Commission in reference to sleeping car rates.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

John W. Newlean has been appointed General Auditor of the Chicago Great Western, succeeding C. O. Kalman, resigned.

R. C. Wight, Secretary to the Receivers of the Chicago Great Western, has resigned, and that position has been abolished.

The office of W. E. Crane, Vice-President of the Fort Smith & Western, has been moved from Fort Smith, Ark., to St. Louis.

Robert McCulloch, Vice-President and General Manager of the United Railways of St. Louis, has been elected President, succeeding John I. Beggs, resigned.

George B. Harris, President of the Chicago, Burlington & Quincy, has been elected also President of the Colorado & Southern, succeeding Frank Trumbull, resigned.

Daniel Willard, Second Vice-President of the Chicago, Burlington & Quincy, has been elected also President of the Colorado Midland, succeeding Frank Trumbull, resigned.

F. W. Estabrook has been elected President of the St. Paul & Des Moines, succeeding G. A. W. Dodge, resigned. F. C. MacMillan, General Manager, has been elected Vice-President.

Adrian Iselin, Jr., Vice-President of the Buffalo, Rochester & Pittsburgh, has been elected President, succeeding Arthur G. Yates, deceased. W. T. Noonan, General Manager, has been elected also Vice-President.

John D. Shields, Auditor of Freight and Ticket Accounts, of the Chicago, Burlington & Quincy, at Omaha, Neb., has been appointed Auditor of Freight Accounts, with office at Chicago, succeeding C. D. Bird, transferred to other duties. J. W. Newell succeeds Mr. Shields.

John R. Sharpe has been elected to the new office of Second Vice-President of the Georgia, Florida & Alabama, with office at Bainbridge, Ga. J. L. Nisbet, Assistant Secretary and Assistant Treasurer, has been elected Secretary and Treasurer, with office at Savannah, Ga., succeeding J. F. Dusenbury, resigned.

Donald Rose, whose appointment as Assistant to the President of the Illinois Central has been previously announced, was born in Scotland and came to Canada when a boy. He spent two years in the Traffic Department of the Grand Trunk, at Montreal, and later served in the Traffic departments of the Chicago, Rock Island & Pacific and the Atchison, Topeka & Santa Fe. In 1892 he entered the General Freight offices of the Illinois Central and when the Western extension was completed to Omaha he was made Commercial Agent, at Salt Lake City, Utah. In 1902 he was appointed Assistant to the Second Vice-President. In 1904 he was appointed General European Agent, with office at London, England, where he was in charge of the traffic interests of the Illinois Central. He remained in that position until his recent appointment on February 1 as Assistant to the President, with office at Chicago.



Donald Rose.

Operating Officers.

J. B. Chandler has been appointed Car Service Agent of the Minneapolis & St. Louis and the Iowa Central, with office at Minneapolis, Minn.

G. S. Stoner, who was appointed Trainmaster of the Missouri, Kansas & Texas of Texas in August, 1906, and was later temporarily assigned to the position of General Agent, at Denison, Tex., during congestion of traffic in the yard, and whose return to the position of Trainmaster was deferred on account of changes in superintendents, resumed his position as Trainmaster, at Denison, on February 1. This corrects an item in our issue of February 5.

P. J. O'Neil, Superintendent in charge of operation and construction of the Lead Belt Railway, the property of the Federal Lead Co., has been appointed also Assistant Superintendent of the Illinois Central at Flat River, Mo. He began railway work in 1884 as a laborer and was later made foreman, and while so employed learned telegraphy. Three years later he went to the employ of the Chicago & Eastern Illinois, where he worked on construction and later as brakeman, operator and agent. Four years later he was made despatcher of the Great Northern, at Havre, Mont., and in 1897 became General Agent and General Yardmaster of the St. Louis, Iron Mountain & Southern at St. Louis. He was for some time President of the Carondelet Business Men's Association of St. Louis, and in 1907 resigned to become Superintendent of the Lead Belt Railway, with office at Flat River, which position he retains.

Traffic Officers.

C. M. Calvin has been appointed Division Agent of the Chicago, Rock Island & Pacific at Trenton, Mo.

F. J. Thomure has been appointed Traffic Manager of the Mississippi River & Bonne Terre, with office at Bonne Terre, Mo.

John H. Schultz, Traveling Agent of the Chicago & North Western, at Pittsburgh, Pa., has been appointed Traveling Passenger Agent at Buffalo, N. Y.

J. K. McNab, Traveling Freight Agent of the Canadian Pacific, at Portland, Ore., has been transferred to Vancouver, B. C. George L. Morrison succeeds Mr. McNab.

E. L. Whitney, Commercial Agent of the Louisiana Railway & Navigation Co., at Dallas, Tex., has been appointed General Agent for the state of Texas, with office at Dallas.

John C. Wood, Commercial Agent of the Chicago, Indiana & Southern, at Chicago, has been appointed Commercial Agent of the Chicago, Milwaukee & Puget Sound, at Chicago. John T. MacTaggart succeeds Mr. Wood.

H. C. Powell, Traveling Freight Agent of the Illinois Central and Indianapolis Southern, at Indianapolis, Ind., has been appointed Commercial Agent at Dubuque, Iowa, succeeding W. S. Benson, deceased. R. A. Barr succeeds Mr. Powell.

J. N. Steele, Traveling Freight Agent of the Trinity & Brazos Valley, at Houston, Tex., has been appointed Soliciting Freight Agent at Houston. H. J. Neff has been appointed Traveling Freight Agent at Houston.

J. R. Hurley has been appointed General Agent, Passenger department, of the New York Central lines west of Buffalo, at Milwaukee, Wis. J. S. Willebrands has been appointed Traveling Passenger Agent for the state of Wisconsin, with office at Milwaukee.

W. B. Ryan, Vice-President and General Manager of the Tehuantepec National, has been appointed General Traffic Manager of the National Railways of Mexico. H. Lawton, Freight Traffic Manager of the Mexican Central, and C. W. Fish, General Freight Agent of the National Lines of Mexico, have been appointed General Freight Agents of the National Railways of Mexico.

J. G. Love, Division Freight and Passenger Agent of the Chicago, Milwaukee & St. Paul, at Sioux City, Iowa, has been appointed Division Freight and Passenger Agent in charge of the Des Moines division, with office at Des Moines, Iowa, succeeding S. H. Vaughan, assigned to other duties. C. N. Curtis succeeds Mr. Love and will have charge of the Sioux City and Dakota division and that portion of the Iowa and Dakota division south of Marion Junction to Running Water, S. Dak.

Engineering and Rolling Stock Officers.

Robert Belton, Roadmaster of the Atchison, Topeka & Santa Fe, at Florence, Kan., has resigned.

W. H. Edgecombe has been appointed Bonus Supervisor of the Western Grand division of the Atchison, Topeka & Santa Fe, with office at La Junta, Colo.

F. C. Pickard, Master Mechanic of the Mississippi Central, has been appointed Master Mechanic of the Cincinnati, Hamilton & Dayton, at Moorefield, Ind., succeeding C. B. Cadman, resigned.

D. W. Hickey has been appointed Foreman of Construction Equipment of the Chicago, Burlington & Quincy, at Galesburg, Ill., succeeding O. W. Duffy, resigned to accept service with another road.

George L. Moore, whose resignation as Chief Engineer of the Rutland has been previously announced, has been appointed Engineer of Maintenance of Way of the Lehigh Valley, succeeding R. G. Kenly, resigned.

Purchasing Officers.

W. Josselyn, Storekeeper of the Chicago, Burlington & Quincy, at Plattsmouth, Neb., has been appointed Storekeeper at Sheridan, Wyo., succeeding B. G. McKeen, resigned to engage in other work. H. M. Regnier, Storekeeper at Hannibal, Mo., succeeds Mr. Josselyn. J. F. Rothschild, Storekeeper at St. Joseph, Mo., succeeds Mr. Regnier, and J. L. Feemster succeeds Mr. Rothschild.

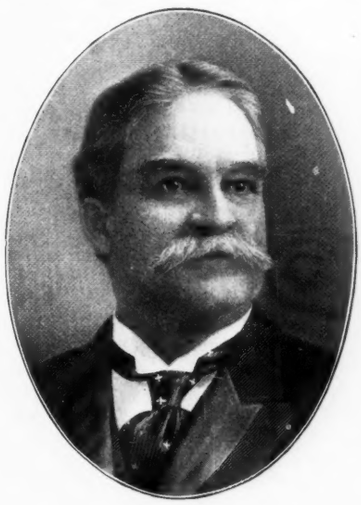
OBITUARY.

Richard C. Moore died at his home in Richmond, Staten Island, N. Y., on February 12, after an illness of about 10 days. He was at one time Purchasing Agent for the New York Central Lines.

John C. Williams, President of the Forest City Iron & Steel Co., and formerly Chief Engineer of the Cleveland & Mahoning, now the Mahoning division of the Erie, died February 8 at his home in Cleveland.

Samuel H. Chaittenden, formerly a civil engineer, died at Washington, D. C., on February 15. He was in charge of survey work on the Union Pacific in 1866, and for many years was in the employ of the government.

Arthur G. Yates, the announcement of whose death appeared in our issue of last week, had been President of the Buffalo, Rochester & Pittsburgh since 1890. Under his administration the road has increased its mileage from 304 miles to 568 miles, and its gross earnings, which were $2,542,158, or at the rate of $8,362 per mile in the first year of the administration of Mr. Yates, were $8,408,145, or at the rate of $14,803 per mile last year. Mr. Yates was born at East Waverly, N. Y., in 1843. In 1865 he entered the employ of the Anthracite Coal Association, which represented the Delaware, Lackawanna & Western, the Delaware & Hudson and the Pennsylvania Coal Co., in Rochester, N. Y. Two years later he went in business for himself, and in 1876 organized the firm of Bell, Lewis & Yates in Buffalo, N. Y. Later he organized the Lehigh & Franklin Coal Co., which handled both anthracite and bituminous coal at Chicago and other lake ports. The Bell, Lewis & Yates firm was later incorporated as the Bell, Lewis & Yates C. M. Co., Mr. Yates retiring from its management in 1890, when he became President of the Buffalo, Rochester & Pittsburgh, but in May, 1896, control of the company was again placed in Mr. Yates' hands. Mr. Yates brought to his work an untiring industry and a rare good judgment. His mind was constructive and comprehensive. He was prompt in decision and a man of unusual force.



A. G. Yates.

Railroad Construction.

New Incorporations, Surveys, Etc.

BEAVER VALLEY & NORTHWESTERN.—An officer writes that this company was organized to build a line from Oklahoma City, Okla., northwest to Lajunta, Colo., about 500 miles. Surveys made and line located from Gage, Okla., where connection is to be made with the Atchison, Topeka & Santa Fe, west via Beaver City to Hooker, where connection is to be made with the Chicago, Rock Island & Pacific, about 105 miles. Right of way secured for 80 per cent. of the way, and contract for construction let to T. E. Luttgerding, of Wichita, Kan. Work is to be begun in May. J. W. Webb, President, Beaver City, and C. H. Holmes, Secretary, Gage, Okla. (Nov. 13, p. 1373.)

CALIFORNIA NORTHEASTERN.—See Southern Pacific.

CAROLINA, CLINCHFIELD & OHIO.—This company's plans call for a line from Elkhorn City, Va., south through Tennessee and North Carolina to Spartanburg, S. C., 285½ miles. The line is in operation from St. Paul, Va., where connection is made with the Norfolk & Western, south to Speer's ferry, about 38 miles, where connection is made with the Virginia & Southwestern; also from Johnson City, Tenn., where connection is made with the Southern Railway, south to Marion, N. C., 98 miles. An officer writes that it is expected the line from Dante, Va., south to Bostic, N. C., 211 miles, where connection is to be made with the Seaboard Air Line, will be opened for through traffic not later than February 20. (Oct. 16, p. 1175.)

CHICAGO, MILWAUKEE & PUGET SOUND.—St. Paul Pass tunnel, the Chicago, Milwaukee & Puget Sound Ry.'s tunnel through the Bitter Root mountains, had the headings connected February 9. The alinement was within 0.03 of a foot and the levels within 0.01, and therefore practically exact. The excavation during January amounted to approximately 750 ft. of the entire section. A description of the methods used in digging this tunnel was given in the *Railroad Age*

Gazette, October 9, 1908. K. C. Weedin was Engineer and Winston Bros. Co. the contractor.

Chicago, Rock Island & Pacific.—An officer writes regarding the line from Wildorado, Tex., west to Tucumcari, N. Mex., 92 miles, that it was partially graded in 1904. It is expected to finish the line and put it in operation by December, 1909. This will give a direct line from Memphis via Tucumcari to El Paso and California. All the Rock Island tributary lines will use this short cut instead of going, as at present, from Amarillo, north to Dalhart, thence south to El Paso. (Jan. 29, p. 235.)

Chihuahua & Pacific.—See Kansas City, Mexico & Orient.

Colorado & Mexico.—An officer writes that this company, which was incorporated this year to build a line from Douglas, Ariz., via Sulphur Springs valley to Courtland, 40 miles, began grading on January 10. The entire line is under contract to Powers & O'Connor, contractors, El Paso, Tex. J. L. Campbell, Chief Engineer, Bisbee, Arizona.

Delaware, Lackawanna & Western.—The double-track tunnel through Bergen Hill, N. J., was opened for traffic last week. The new tunnel parallels the old one, and the two are 51½ ft. apart. Together they will make a four-track line through to Hoboken, N. J. The new tunnel is less than a mile in length. Fuller details are given in another column. (March 13, p. 391.)

Des Moines & Sioux City (Electric).—Contracts for the construction of this line have been let to the American Engineering Co., contractors, Indianapolis, Ind. Options have been secured on most of the right of way along the three different routes in view. The building of this road depends largely upon the success of the American National Corporation Co., of Indianapolis, which company has in hand the financing of the line. (Sept. 11, p. 932.)

Galesville & Etric.—See Western Transportation Co.

Gulf, Colorado & Santa Fe.—An officer writes that it is expected to have work on the Texas & Gulf, building from Center, Tex., to Zuber, 21.3 miles, finished by June. Work was suspended in February, 1908, and resumed in October. John Scott & Sons, St. Louis, Mo., are the contractors. (Feb. 12, p. 330.)

Hudson & Manhattan.—Plans have been filed by this company with the New York Public Service Commission, First district, to extend the subway from its proposed terminus at Thirty-third street and Sixth avenue, Borough of Manhattan, New York, to the Grand Central Station in Forty-second street. The plans call for a two-track subway from Thirty-third street, up Sixth avenue, thence under Bryant park near Fortieth street, entering Forty-second street west of Fifth avenue, and through Forty-second street to the Grand Central Station. The new subway is to run beneath the present Interborough subway along Forty-second street.

Iowa & Southwestern.—Organized in Iowa, with $300,000 capital, and office at Clarinda, Iowa. The company proposes to build a line from Clarinda southwest via College Springs to Blanchard, in Page county, about 18 miles. Preliminary surveys and estimates of the cost of construction have been made. W. F. Farquhar, President, College Springs, and J. N. Miller, Vice-President, Clarinda.

Jonesborough, Lake City & Eastern.—Incorporated in Texas to build a railway from Uvalde, Texas, to Laredo, 125 miles. The proposed line will connect with the Southern Pacific at Uvalde and the International & Great Northern at Laredo.

Kansas City, Mexico & Orient.—An officer writes the following as a synopsis of progress up to February 1. This synopsis follows the proposed line from Kansas City to Topolobampo, Mex.

The Kansas City Outer Belt Electric, which will furnish an entrance into and terminal facilities at Kansas City, Mo., is practically graded and concrete culvert work completed. The necessary steel bridges, with the exception of that crossing the Missouri river, are on hand. This line will be double-tracked with 90-lb. rails. It is probable that the construction work will be resumed during the present year. No grading has been done on the line from the western terminus at Kansas City, Kan., to Emporia, a distance of 108 miles.

From Emporia to Eldorado, 61 miles, the grading is about completed, and two miles of track are laid north from Eldorado. The steel bridge material is now on the ground and ready for erection.

No construction work has been done on the section from Eldorado to Wichita, Kan., 32 miles.

From Wichita to Sweetwater, Tex., 433 miles, the line is completed and in operation.

From Sweetwater to San Angelo, 78 miles, grading is completed and 11 miles of track laid north from San Angelo. Rails and ties are now on the ground at San Angelo with which to continue track laying north from that point for a distance of 10 miles. The steel for the bridge over the Concho river at San Angelo is also on hand.

From San Angelo to the Rio Grande river, 304 miles, no construction work has been done.

From the Rio Grande river to Chihuahua, Mex., 170 miles, the line is completed and in operation for a distance of 90 miles east from Chihuahua and grading is completed for 12 miles further east.

From Chihuahua to Minaca, 122 miles, the K. C., M. & O. operates over the Chihuahua & Pacific.

From Minaca west to Sanchez, on the western slope of the Sierra Madres, 76 miles, the line is completed and in operation and grading is completed for nine miles beyond Sanchez.

From Las Hornillos to Topolobampo, 74 miles, the line is completed and in operation. Twenty-one miles of grading is finished beyond Las Hornillos, leaving a gap of 166 miles of grading and 196 miles of track yet to be completed on the western slope of the mountains.

Kansas City Outer Belt (Electric).—See Kansas City, Mexico & Orient.

Kansas City Southern.—An officer writes that grading between Howe, Okla., and Heavner, has been completed, and that track laying and bridging on this cut-off has been postponed. (March 13, p. 391.)

Lake Superior & Ishpeming.—An officer writes, regarding the change of line through Negaunee, Mich., that the work is about completed, including the grade reduction, and that the line will probably be open for traffic early in the present summer. The steel bridges, including two viaducts, 285 ft. and 305 ft. long respectively, were erected by the Toledo-Massillon Bridge Co.

Louisiana & Pine Bluff.—An officer writes that work on the extension from Dollar Junction, Ark., to New London, 15 miles, and from New London to Wilmington, 15 miles, has been abandoned for the present. (March 13, p. 392.)

Manila Railway.—An officer writes that this company started grading about two years ago on the Island of Luzon, P. I., building lines aggregating 428 miles for a syndicate formed by Speyer & Co., during the past year. Up to December 7 the company opened 125 miles of railway for traffic. About 40 miles additional are partly completed. No contracts are to be let for any of the work. J. G. Metcalfe, Vice-President, and A. W. Clark, Secretary and Treasurer, New York.

Marshall & East Texas.—An officer writes that this company has spent about $100,000 rehabilitating the old line between Marshall, Tex., and Winnsboro. New ties have been laid, new bridges built, and a small amount of new track laid. No work has yet been done reducing the grade and taking out bad curves, but it is expected some of this work will be carried out in 1909. Negotiations are pending with residents of Marshall for rights of way, etc., for its proposed extension south. It is expected that satisfactory arrangements will be made soon and the line extended about 20 miles. Maximum grades on this extension will be five-tenths of one per cent., and maximum curvature about 4 degrees. (Jan. 1, p. 36.)

Mexican Southern.—An officer writes that this company is building an extension from Oaxaca, Mex., in the state of Oaxaca, south via Zimatlan and San Pablo Huixtepec to Taviche, 34 miles. The line has been built from Oaxaca to San Pablo, and grading contract let for the remaining 16 miles from that place to Taviche.

Missouri, Oklahoma & Gulf.—Press reports from Muskogee, Okla., say that negotiations were finished recently to extend this road from Calvin, Okla., south to Denison, Tex., 92 miles. (July 3, p. 457.)

MISSOURI PACIFIC.—An officer writes that contracts amounting to $250,000 have been let to the L. J. Smith Construction Co., Kansas City, Mo. The work includes ballasting on the Valley, Natchez and Memphis divisions, and bridge filling work on the Memphis division.

MONTANA ROADS.—A company is being organized by M. S. Darling, of Conrad, Mont., and associates, to build a line from Conrad, where connection is to be made with the Great Northern, to Valier, 27 miles. Grading is to be started this coming spring or summer. The line will traverse an irrigation district of 160,000 acres, to be opened for settlement soon.

MONTANA, WYOMING & SOUTHERN.—According to press reports, contracts are to be let soon for building this proposed line from Sheridan, Wyo., northeast to Miles City, Mont., about 150 miles. R. H. Walsh, President of the First National Bank of Sheridan, is President. (Oct. 23, p. 1227.)

NEW YORK, NEW HAVEN & HARTFORD.—Final authority has been given by the New York Public Service Commission, Second District, for the building of the New York, Westchester & Boston. In January last the commission granted a certificate of public necessity and convenience, with the stipulation that a rehearing should be held. This rehearing was held on February 10, when all oppositions to the project were withdrawn and the company is now free to proceed with the work. (Jan. 15, p. 139.)

NEW YORK, PITTSBURGH & CHICAGO AIR LINE.—An officer writes that during the past year engineers have been at work revising the line of this company. The projected route is from Pittsburgh, Pa., east via Indiana, Cherry Tree, Irvona, Sandy Ridge, Loneville, Tusseyville, New Berlin, Sunbury, Mahanoy City and Tamaqua to Allentown, 298 miles. It is expected that construction work will be started during 1909. The line from Pittsburgh to the Susquehanna river, 188 miles, as shown by the surveys, will have a maximum grade east of 15 ft. to the mile, with no pusher grades, and 20 ft. westbound with nine miles of 60-ft. grade up eastern slope of Allegheny mountains at Sandy Ridge. Maximum curvature Pittsburgh to the summit of the Allegheny mountains 2 deg. Maximum curvature entire line 3 deg. Joseph Ramsey, Jr., Orange, N. J., is interested.

NEW YORK, WESTCHESTER & BOSTON.—See New York, New Haven & Hartford.

NORTH & SOUTH CAROLINA.—An officer writes that this company has leased from the Seaboard Air Line a branch running from Hamlet, N. C., to Gibson, 11 miles. This line has been extended from Gibson via McColl, S. C., to Clio, 15 miles, and is now in operation, completing the road. W. R. Bonsal & Co., of Hamlet, N. C., were the contractors. W. R. Bonsal is President and Treasurer of the railway.

OHIO RAILWAY (ELECTRIC).—An officer writes that this company has completed the line from Bellefontaine, Ohio, to Lima, 33 miles; also the line from Lima to Toledo, 73 miles. (March 27, p. 393.)

PITTSBURGH, BINGHAMTON & EASTERN.—This company, organized to build a line from Binghamton, N. Y., southwest to Clearfield, Pa., 232.5 miles, was placed in the hands of a Receiver late in 1908. We are told that a reorganization of the company may be effected at an early date, and work on the line resumed. About six miles of track have been laid between Powell, Pa., and Canton, and about 20 miles of grading is finished. Some four bridges have already been put up. Contract was let previous to placing the road in the hands of Receivers to Wm. J. Oliver & Co., of Knoxville, Tenn. Rivenac & Co., who have a sub-contract for some of the work, are on the ground at Canton with their men and outfit, but are doing no work as yet. Louis T. McFadden, John P. Reynold, Jr., and Fred C. Leonard, Canton, Pa., are the Receivers. (Sept. 18, p. 981.)

PORT O'CONNOR, RIO GRANDE & NORTHERN.—Press reports indicate that a general contract for building and equipping this proposed line to J. H. Collins, contractor, Chicago. (Feb. 5, p. 282.)

ROCHESTER, SYRACUSE & EASTERN.—See Syracuse, Lake Shore & Northern.

ROGUE RIVER & OREGON SOUTHERN (ELECTRIC).—An officer writes that this company, incorporated in Oregon to build from Grant's Pass, Ore., on the Oregon Railroad & Navigation Co., southwest through the Rogue river valley, a rich timber section, to Waldo, about 50 miles, has obtained franchises from the city of Grants Pass, and the county of Josephine, to build its proposed electric line over the public highways and streets. Water power on the Illinois river has been located, and it is expected to begin construction work this spring. O. S. Blanchard, of Grants Pass, is interested. (Sept. 11, p. 934.)

SALEM, FALLS CITY & WESTERN.—An officer writes that work on this line, building from Dallas, Ore., east to Salem, 14 miles, has been suspended during the winter and is to be resumed about April 1. It is expected to have the entire line finished by October. Rails have been bought, some of which are already on the ground. L. Gerlinger, President, Portland, Ore. (Aug. 7, p. 693.)

SOUTHERN PACIFIC.—An officer of the California Northeastern writes that this line, which connects with the Southern Pacific main line at Weed, Cal., is now in operation northeast to Holland, Ore., 74 miles. Construction is under way from Holland north to Klamath Falls, 14 miles. (Dec. 18, p. 1610.)

SPARTA RAILWAY & POWER COMPANY.—See Western Transportation Co.

SYRACUSE, LAKE SHORE & NORTHERN (ELECTRIC).—An officer writes that this company started operating January 1 its extension from Baldwinsville, N. Y., north to Fulton, 15 miles, and will probably build a further extension from Fulton northwest to Oswego, about 20 miles, during 1909.

Contracts are to be let in March for building an extension of the Rochester, Syracuse & Eastern from Port Byron, N. Y., east to Syracuse, about 35 miles. Surveys have been made and franchises and rights of way secured. (Sept. 25, p. 1028.)

TERRE HAUTE & SOUTHERN INDIANA.—Incorporated in Indiana, with $50,000 capital, to build a line from Terre Haute, Ind., west through Illinois to the Missouri state line, about 200 miles, with a branch southerly through Vigo and Sullivan counties, Ind., to coal fields. The directors include H. C. Pugh, R. G. Wasson, Robert Herkimer, S. C. McKeen, H. B. Bement, H. P. Taussig and Charles Minshall.

TEXAS & GULF.—See Gulf, Colorado & Santa Fe.

TEXAS ROADS.—John B. Carrington, Secretary of the Business Men's Club, San Antonio, Tex., writes, regarding building of a railway from San Antonio, south to Brownsville, about 300 miles, that J. F. Edwards, of St. Louis, representing capitalists of that place, failed to meet the conditions in regard to building this line and that negotiations with him have ceased. The city of San Antonio still has $100,000, of which it is prepared to give $75,000 as a cash bonus and the remainder to be used in obtaining rights of way to the Bexar county line and securing terminals within the city. Several groups of capitalists are figuring on this proposition, but no definite contract has as yet been submitted and the Business Men's Club of San Antonio is free to entertain propositions from any capitalists or railway builders wishing to build this line. The city of San Antonio does not intend to build this road itself, nor does it wish to employ any engineers to make preliminary surveys, nor does it wish to finance the road itself. The city and the people of the country through which the line will pass are willing to give as a bonus, either in lands or money, approximately $1,000,000 and to make contracts with responsible railway builders, who in turn will be required to give evidence of substantial financial backing and to furnish satisfactory bond. The city of San Antonio, through the Business Men's Club, will be glad to open negotiations with any bona fide capitalists or railway builders. (Nov. 13, p. 1375.)

VIRGINIA & SOUTHWESTERN.—An officer writes that this company, which is building the Holston River extension, a 40-mile line which will connect the V. & S.W. at Moccasin Gap, Va., with the Southern at Persia, Tenn., is now receiving bids for the construction of this line. This work was begun about three years ago and about 75 per cent. of the grading and masonry work was completed. In this resumption it is proposed to have the line finished and ready for operation in October. (Feb. 12, p. 331.)

WESTERN TRANSPORTATION COMPANY.—This company, of which J. N. Braun is President and General Manager; A. B.

Karns, Secretary, and C. Oehler, Chief Engineer, with office at St. Paul, Minn., has surveys made and rights of way secured on 30 miles, for a line to be built from Portage, Wis., north via Briggsville, Oxford, Friendship and Arkdale to Grand Rapids, about 70 miles.

Negotiations have been finished for taking over the Sparta Railway & Power Co., organized to build a line from Sparta, Wis., northwest via Angelo, Trout Falls and Cataract to Melrose, 28 miles. Contracts let to local parties to build the entire line. Contracts are to be let soon for a number of bridges, one to have a total length of 800 ft., including the approaches. Shops and car barns are to be put up at Sparta. Steam power is to be used for freight service, and gasolene motor and gasolene-electric cars will be used for passenger service.

The Galesville & Etric, which has also projected a line in Wisconsin, will be built in 1909 by the W. T. Co., as well as a 60-mile interurban electric line in Montana.

Williamsport & North Branch.—An officer writes that although surveys have been made for an extension from Bernice, Pa., to coal mines, about four miles, it is probable that arrangements will be made to use the tracks of the Lehigh Valley as heretofore, instead of building the extension.

Railroad Financial News.

Baltimore & Ohio.—See Cincinnati, Hamilton & Dayton.

Boston & Maine.—See New York, New Haven & Hartford.

Carolina, Clinchfield & Ohio.—The company has sold $2,600,000 5 per cent. equipment notes, series A, dated December 1, 1908, due in semi-annual instalments of $130,000 each, beginning June 1, 1909, and ending December 1, 1918.

Chesapeake & Ohio.—Edwin Hawley, Frank A. Vanderlip, John W. Castles, Frank Trumbull, H. E. Huntington and F. W. Scott have been elected directors. The retiring directors are Samuel Rea, Walter G. Oakman, Thomas P. Fowler, J. P. Green, Temple Bowdoin and Martin Erdmann. This is a further step in the transfer of the control of the Chesapeake & Ohio from Pennsylvania and Vanderbilt interests to Edwin Hawley and associates.

Chicago, Burlington & Quincy.—The First National Bank, J. P. Morgan & Co., and the National City Bank, New York, are offering $15,000,000 Chicago, Burlington & Quincy general mortgage 4 per cent. bonds of 1908-1958 at 99½. This is part of an authorized issue of $300,000,000, of which there was previously outstanding $16,000,000. It is understood that the Burlington sold these bonds to reimburse itself for the recent purchase of Colorado & Southern stock.

Chicago Railways.—N. W. Harris & Co. and the National City Bank, New York, have bought $6,000,000 first mortgage 5 per cent. bonds of 1907-1927 issued to pay for extensions and improvements. The bonds are being offered to the public at 101.

Cincinnati, Hamilton & Dayton.—The Federal court has appointed a special master to report on the receipts and expenditures of the receiver. The present receiver, Governor Harmon, says that he will retire as receiver on May 1.

It is understood that the Baltimore & Ohio is to take some part in the reorganization of the C., H. & D.

Colorado & Northwestern.—This road is to be sold at foreclosure at Boulder, Colo., on March 29. An upset bid of $250,000 is fixed. The road runs from Boulder, Colo., to Sunset, where it branches, one line going to Ward and one to Eldora. It has, including spurs, about 50 miles of track. It has been operated by W. B. Hayes as Receiver for about two years.

Colorado & Southern.—George F. Baker, J. W. Blythe, W. P. Clough, George B. Harris, James J. Hill, James N. Hill, Darius Miller, E. P. Nichols and Daniel Willard have been elected directors, and W. F. Crandall, H. E. Huntington, William Shillaber, T. P. Shonts, Henry Walters, Levi C. Weir, B. F. Yoakum, James Campbell and Henry H. Wehrhane have retired from the board. George B. Harris, President, of the Chicago, Burlington & Quincy, has been elected also President of the Colorado & Southern and chairman of the board, succeeding G. M. Dodge. Harry Bronner, Edwin Hawley, G. M. Dodge and Frank Trumbull have been re-elected directors.

Colorado Midland.—George B. Harris, President of the Chicago, Burlington & Quincy; Daniel Willard, Second Vice-President, and W. T. Clough, Vice-President of the Great Northern, have been elected directors of the Colorado Midland, succeeding Frank Trumbull, G. M. Dodge and A. C. Rearick. This marks a further step in the transfer of the control of the Colorado & Southern and allied lines from the Edwin Hawley interests to the Burlington interests.

Erie.—The New York Public Service Commission, Second district, has given permission to this company to issue $30,000,000 bonds. (See an article in another column.)

Fall Brook Railway.—See Geneva, Corning & Southern.

Geneva, Corning & Southern.—Stockholders of the Fall Brook Railway, the Syracuse, Geneva & Corning and the Pine Creek Railway will vote on March 16 on the plan to ratify the action of the directors in consolidating these companies into a new company to be known as the Geneva, Corning & Southern, which will own about 230 miles of railway. The three companies which are to consolidate are leased to the New York Central & Hudson River.

Interoceanic of Mexico.—See National Railways of Mexico.

Louisville & Eastern.—See Louisville Traction Co.

Louisville Railway.—See Louisville Traction Co.

Louisville Traction Co.—This holding company, owning nearly all of the stock of the Louisville Railway, has acquired control of the Louisville & Eastern, now in the hands of receivers. The Louisville Railway operates 145 miles of electric railways in Louisville, Ky. The Louisville & Eastern operates 27 miles of road running from Louisville to Beards and La Grange over a private right of way.

Metropolitan Street Railway (New York).—Two-thirds of the $12,500,000 outstanding general mortgage and collateral trust 5 per cent. bonds have been deposited, under the plan of the bondholders' protective committee, A. J. Hemphill, chairman, with the Guaranty Trust Co., New York, and the time for depositing bonds has been extended to January 23.

Mexican Central.—See National Railways of Mexico.

Mexican International.—See National Railways of Mexico.

Minneapolis & St. Louis.—Speyer & Co., New York, recently bought $2,015,000 first and refunding mortgage 4 per cent. bonds of 1899-1949. The proceeds of the sale is to be used by the railway company for retiring $455,000 Minneapolis & Merriam Junction 7 per cent. bonds which matured January 1, 1907, and $1,015,000 Iowa extension 7 per cent. bonds which will mature June 1, 1909.

National Railroad of Mexico.—See National Railways of Mexico.

National Railways of Mexico.—Stockholders of the Mexican Central voted on February 11 to authorize the sale of the property of the Mexican Central to the National Railways of Mexico. The sale of the property of the National Railroad of Mexico was confirmed in October, 1908. The property of the Mexican International and the Interoceanic of Mexico has not been transferred to the National Railways of Mexico. The Mexican Central and the National Railroad Companies having sold all their assets, are subject to dissolution when desired.

Nevada, California & Oregon.—See Sierra Valleys.

New York, New Haven & Hartford.—In answer to certain questions asked by the House of Representatives of Massachusetts, the New York, New Haven & Hartford says that the sale of its holding of the Boston & Maine shares to John L. Billard was in good faith, and was an actual transfer of all rights and voting privileges pertaining to the stock to interests believed to be friendly to the New Haven company. In connection with the question about street

railway holdings, the New Haven company says that as to its railway, the company is subject to the laws of Massachusetts, but that as to its acts as a consolidated corporation it is subject to the charter of the Connecticut corporation.

PINE CREEK RAILWAY.—See Geneva, Corning & Southern.

SIERRA VALLEYS.—The property of this company was sold under foreclosure on January 30 for $75,000 to the Nevada, California & Oregon. Most of the stock and all the bonds of the Sierra Valleys are owned by the N. C. & O. The Sierra Valleys runs from Pulmas Junction, Cal., west to Mohawk, 37 miles, and the Nevada, California & Oregon runs from Reno, Nev., north through Plumas Junction to Alturas, Cal., 184 miles.

SYRACUSE, GENEVA & SOUTHERN.—See Geneva, Corning & Southern.

TWENTY-EIGHTH & TWENTY-NINTH STREET CROSSTOWN (NEW YORK).—J. B. Mayer, temporary receiver, has been appointed permanent receiver in the foreclosure suit brought by the Central Trust Co., New York.

UNITED RAILROADS OF ST. LOUIS (ELECTRIC).—An initial dividend of 3½ per cent. has been declared out of the earnings for the six months ended January 1, 1909, on the $5,000,000 7 per cent. cumulative first preferred stock. The stock is all owned by the United Railways Investment Co.

WICHITA FALLS RAILWAY.—The Texas legislature has been asked to authorize the Wichita Falls Railway to take over and operate the Wichita Falls & Northwestern and the Wichita Falls & Southern. The roads are owned by the same interests. The Wichita Falls runs from Henrietta to Wichita Falls, 20 miles, and is operated under lease by the Missouri, Kansas & Texas. The Wichita Falls & Northwestern runs from Wichita Falls to Frederick, Okla., 50 miles, and is being extended to Paul's Valley, another 50 miles. The Wichita Falls & Southern is being built south from Wichita Falls. More than 55 miles of this line are completed and in operation.

WISCONSIN CENTRAL.—Newman Erb, President; F. N. Prince, Mark T. Cox and J. S. Bache have been appointed a committee to take up with the Minneapolis, St. Paul & Sault Ste. Marie the subject of completing a lease of the Wisconsin Central by the Soo.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The St. Joe & Grand Island expects soon to be in the market for 10 locomotives.

The Temiskaming & Northern Ontario is in the market for two switching locomotives.

The Georgetown & Western has ordered one locomotive from the Baldwin Locomotive Works.

CAR BUILDING.

The Missouri, Kansas & Texas is asking prices on 30 passenger coaches.

The Wabash-Pittsburgh Terminal is said to be asking prices on 200 fifty-ton steel hopper cars. This item is not confirmed.

The J. D. McArthur Co., Winnipeg, Man., has ordered 50 thirty-ton flat cars from the Crossen Car Manufacturing Co.

The Abilene & Southern, Abilene, Tex., has ordered two combination passenger and baggage cars from A. V. Kaiser & Co.

The Findlay-Marion Railway & Light Co., G. W. Meeker, Columbus, Ohio, will soon be in the market for 12 interurban cars.

The Intercolonial has ordered two 60-ft. baggage cars from the Preston Car & Coach Co. and three baggage cars from the Crossen Car Manufacturing Co.

IRON AND STEEL.

The Great Northern has ordered 285 tons of structural steel for a grain elevator at Superior, Wis.

The Wheeling & Lake Erie has ordered 3,500 tons of rails from the Carnegie Steel Co. for delivery before April 1.

The Chicago & North Western has ordered 375 tons of structural steel from the Illinois Steel Co. for a new bridge at Chicago.

The Chicago Great Western, reported in the *Railroad Age Gazette* of February 5 as being in the market for 5,000 tons of rails, has placed this order with the Illinois Steel Co.

The Crane Co., Chicago, reported in the *Railroad Age Gazette* of January 22 as being in the market for 2,500 tons of structural steel for a warehouse at Chicago, has placed this order with Vierling, McDowell & Co., Chicago. The general contractors for the erection of the building are Lanquist & Illsley, Chicago, as reported on February 5.

RAILROAD STRUCTURES.

CHICAGO, ILL.—Frost & Granger, architects, Chicago, are preparing plans for two passenger stations to be built at Evanston, Ill.; a new station at Calvary, Ill., and a new station at Irving Park boulevard and Ravenswood Park, Chicago, for the Chicago & North Western. The stations at Evanston and Calvary will cost $30,000 each and the station within the city limits $10,000. They will be one story, of pressed brick and stone, and will be finished with oak, tile and mosaic work.

The inbound freight house of the Wabash, corner of Twelfth and Clark streets, was destroyed by fire on February 10. Two lives were lost. The estimated loss is $500,000.

The Chicago, Rock Island & Pacific will erect a two-story office building at Seventy-first street and Stewart avenue for the Auditing and Car Service Departments.

CISCO, TEX.—The Texas & Pacific and the Texas Central have prepared plans for a joint passenger station at Cisco. This building will be erected soon. Cost, $8,000.

EAST YOUNGSTOWN, OHIO.—The Youngstown & Ohio is said to have bought land in Youngstown as a site for a passenger station, freight house and yards.

GREENVILLE, TEX.—The creosoting plant of the Missouri, Kansas & Texas was burned on February 8 at a loss of about $150,000. It has not been decided whether or not the plant will be rebuilt.

JACKSONVILLE, ILL.—The Chicago & Alton has given the contract for building the new passenger station to John W. Evans & Sons Co., of Bloomington, Ill. (Feb. 5, p. 284.)

KENNEWICK, WASH.—The North Coast has given the contract for the construction of a steel and masonry bridge over the Columbia river to the Puget Sound Bridge & Dredging Co., Seattle, Wash. It will cost about $1,000,000.

TAYLOR, TEX.—The International & Great Northern will commence work soon upon the rebuilding of the roundhouse and shops destroyed last fall. The new structures will cost $50,000. (Sept. 25, p. 1022.)

TOLEDO, OHIO.—The Ohio Electric Railway is at present building large freight and passenger terminals which will be completed about March 15.

SIGNALING.

On February 14th the Rock Island changed the night color indications of the signals and switches on the Chicago Terminal Division (Chicago to Blue Island). Formerly the colors were red for stop, green for caution and white for clear, and green was also used for the adverse indication of a siding switch. The new colors are: red, stop; yellow, caution; green, clear; and yellow is also used for the adverse indication of a siding switch.

New Automatics on Rock Island.

The Rock Island has just completed the installation of automatic block signals on the Kansas Division, single track, between Topeka and Herington, 80.2 miles. There are 125 signals. Of these two are normal danger, two-position; two are normal danger, three-position and two are normal caution, three-position; these are all in McFarland yard, the special arrangement being made to meet local conditions. The remainder are normal clear, three-position, with the exception of two which are two-position and one semi-automatic distant signal for the Topeka interlocking plant. Switch indicators are provided at all switches remote from signals; that is to say, at such a distance that trainmen could not obtain authority to open a switch by observing a signal. There are two indicators at each switch in the majority of cases, one indicator showing the approach of a westward train and the other showing the approach of an eastward train.

All signals give indications in the lower, right-hand quadrant and have one arm. Blades are painted yellow, with a black transverse stripe. Signals are style "B," electric motor, made by the Union Switch & Signal Co. Power is supplied by "BSCO" primary batteries, sixteen cells to each signal. All line circuits are polarized. Control circuits are taken through normally closed contacts in switch boxes operated by all facing-point switches in the block of the signal concerned. Switch boxes also shunt the track circuit at every switch when the switch is opened. Track relays are of four ohm resistance; line relays, 500 ohms.

All the apparatus was put in by the railway company's forces.

Forty-Fifth Street Interlocking, Chicago.

The Union Switch & Signal Co. put in service on February 9, 1909, a forty-seven-lever, electric interlocking machine at Forty-fifth street, Chicago, on the Rock Island-Lake Shore Terminal. There are forty-three working levers controlling four high signal arms, thirty-two dwarf signal arms and thirty-four switches. There are two double-arm, high signals mounted on signal bridges, the upper arms being three-position slotted and the lower arms two-position, not slotted. Two of the dwarf signals are double-armed; the upper arm governs straight movements on the main track against traffic.

All signals give indications in the upper, right-hand quadrant, but the dwarf signals clear to 45 degrees only. The distant signals for this plant are Hall enclosed discs, which are part of the automatic block-signal system which already existed on the terminal district. All signals are lighted by electric lights of 2 c.p.

The storage battery is charged from the railway company's 220-volt, direct-current line through a variable resistance.

Electric detector locking is provided on all main line routes, in addition to mechanical detector bars. It is accomplished by breaking the control circuits of the switches through contacts of 500-ohm relays controlled by block indicators. There are two block indicators for each of the two main line tracks and one annunciator for each direction with traffic. The block indicators are of the semaphore type and the annunciators of the disappearing disc type. Each annunciator is provided with a single-stroke bell.

Route-locking is provided for the two main line movements with traffic. This is accomplished by breaking the circuit of a stick relay by means of a contact on the distant signal when the latter clears. The stick relay cannot be restored until the train has passed the home signal, when the detector locking takes effect. This stick relay opens the control circuits leading to the switches in the route. Indication locking is thus also provided for the distant signals, as the stick relay cannot pick up unless the distant signals assume the caution position. Slow hand electric screw releases are provided to release the electric locking in emergencies.

The cabin is three stories high, built of reinforced concrete, with brick trimmings and slate roof. The lower story contains the heating apparatus and switchboard. The battery room is on the second floor, as is also the lavatory and a room for the relays. The third story, where the machine is placed, overhangs on the track side by 4 ft. 1 in. The dimensions of the cabin at the base are 8 ft. 5 in. by 20 ft. The interlocking apparatus was installed by the Union Switch & Signal Co., the electric locking and other adjuncts, together with the cabin, being installed by the Rock Island, which will operate the plant.

High-Speed Tool Steel.

Professor J. O. Arnold, of Sheffield University, announced January 28 in a lecture before the Royal Institution, London, that "in less than a year the efficiency of high-speed steel would be more than quadrupled, and this new steel would be a British steel." Professor Arnold has high standing as a metallurgist, and he consults for the Sheffield steel makers, Jonas & Colver. A cable message, February 16, indicates that the new metal is already in process of manufacture by this firm.

The Strength of "Bled" Pine.

The Government Forestry Department makes the following summary of the results of 1,325 tests of the weight and strength of pine from which the resin has been bled and not bled. The results are astonishingly similar.

Longleaf pine.	No. of tests.	Specific weight of test pcs., Per cent.	Strength, per sq. in. Bending, lbs.	Strength, per sq. in. Compres'n, lbs.
Unbled trees	400	0.74	12,358	7,166
Bled and recently abandoned	390	.79	12,961	7,813
Bled and abandoned 5 years	535	.76	12,586	7,575

Supply Trade News.

The Wm. J. Oliver Manufacturing Co., Knoxville, Tenn., recently finished and put into operation a new erecting shop.

A. V. Kaiser & Co., Philadelphia, Pa., have sold one 78-in. Sellers driving wheel lathe and one Niles 200-ton hydraulic driving wheel press to the Georgia & Florida Ry.

A. F. Conklin has been made Special Representative of the Quaker City Rubber Co., Philadelphia, Pa. Mr. Conklin's headquarters will be at 253 Broadway, New York.

The Walker & Douglas Railway Appliance Co., Hammond, Ind., has been incorporated by William L. Walker, Andrew E. Douglas and E. G. Sproat. Capital stock, $10,000.

K. M. Zorn has been appointed Consulting Engineer and Salesman of the Youngstown Car Manufacturing Co., Youngstown, Ohio, with office at 120 Noble road, East Cleveland, Ohio.

The Corrugated Bar Company (formerly Expanded Metal & Corrugated Bar Co.), St. Louis, Mo., is erecting a building at Youngstown, Ohio, to be used as a warehouse and fabricating shop.

G. C. Goebel has been appointed Representative of the Detroit Graphite Co., Detroit, Mich., with office at Indianapolis, Ind. He will have charge of the Kentucky and Southern Indiana territory.

Harry Vissering, for the last 10 years General Sales Agent of the United States Metallic Packing Co., Philadelphia, Pa., and Superintendent of the American Locomotive Sander Co., Philadelphia, has resigned both positions.

The National Paint Works, New York, has opened a branch office at 1520 Chestnut street, Philadelphia, Pa., in charge of Herbert F. Wallace, and a branch office in the Monadnock building, San Francisco, Cal., in charge of Van E. Britton.

George P. Jones, President of the Jones Car Door Co., Chicago, died on February 10 at his residence in Chicago from paralysis. He was born in 1840, at London, Ohio, and came to Chicago in 1877. He was a member of the Union League Club.

Edwards' all-steel trap doors are to be used on the new coaches being built for the Carolina, Clinchfield & Ohio by the Harlan & Hollingsworth Corporation, Wilmington, Del. The O. M. Edwards Co., Syracuse, N. Y., is the maker of these doors.

The Davenport Locomotive Works, Davenport, Iowa, is hav-

ing plans prepared by W. L. Stebbings, Monadnock block, Chicago, for an additional shop building. It will be a one-story structure, 130 ft. x 200 ft., with brick superstructure and steel trusses.

F. H. Bostwick has been appointed Manager of the Denver, Colo., office of the Wellman-Seaver-Morgan Co., Cleveland, Ohio. Mr. Bostwick will have his headquarters at 611 Ideal building.

The Lord & Burnham Co., Irvington, N. Y., has opened a branch office of its ventilating department in the Heed building, Philadelphia, Pa. It is to be in charge of Albert H. Bates, who has been representing the company from its factory at Irvington.

The Browning Engineering Co., Cleveland, Ohio, has appointed J. R. Traver representative at Denver, Colo., and R. I. Wiswell representative at Atlanta, Ga. They will deal in locomotive cranes, revolving steam shovels, railway ditchers, railway wrecking cranes, buckets and magnets.

The Riter-Conley Manufacturing Co., Pittsburgh, Pa., has just established in the West two new sales offices. One will be in St. Louis, Mo., Third National Bank building, with H. B. Clarke as Resident Manager, and one in Seattle, Central building, with W. H. Dickinson as Resident Manager.

The sales organizations of the Northern Electrical Manufacturing Co., Madison, Wis., and the Fort Wayne Electric Works, Fort Wayne, Ind., are to be merged, with the executive offices at Fort Wayne. This will result in a concentration of manufacture, the Northern works being confined to direct-current apparatus, and the Fort Wayne works to alternating-current machines.

The Indiana Foundry Co., Ltd., Indiana, Pa., reports that its sand drying stove is now used by many of the railways and large industrial plants throughout the country and that the export trade on it is increasing at a satisfactory rate. The company has added a number of heavy heating stoves to its line, such as are used in railway shops, stations, factories, mills, etc., and has been working to the limit of its capacity on these all season.

A selling company has been organized under the name of J. Rogers Flannery & Co., with headquarters at Pittsburgh, Pa., to take over the sale of the Tate flexible staybolt, owned and manufactured by the Flannery Bolt Co., Pittsburgh, Pa. This selling organization will also exploit the Keystone nut lock, also manufactured by the Flannery Bolt Co. The representatives of the new company will be H. A. Pike, New York; W. M. Wilson, Chicago; Grundy & Leahey, Richmond, Va.; Tom R. Davis, Mechanical Expert, Pittsburgh.

The Heine Safety Boiler Co., St. Louis, Mo., has just finished installing for the New York Central & Hudson River boilers for engine houses as follows: Three 125 h.p. at Minoa; three 150 h.p. at Oswego; three 250 h.p. at East Buffalo; three 300 h.p. at Syracuse; three 300 h.p. at Rensselaer, for the B. & A.; four 300 h.p. at Rensselaer, for main line. The Heine Company has also just completed the installation of two 200 h.p. boilers in the Chicago, Rock Island & Pacific shops at Fairbury, Neb., and is about to install a 200 h.p. boiler in the repair plant of the International Car Co., New Orleans, La.

Dodge & Day, Philadelphia, Pa., have a contract with the Lidgerwood Manufacturing Co., New York, for the inspection of shipments of material from the states and the erection of same at the Gatun locks, Canal Zone. This contract covers the inspection and erection complete of six duplex cableways and one single cableway which will be used to handle materials from barges to stores, from stores to mixers, and from mixers to place at the Gatun locks. Dodge & Day were retained in the capacity of Consulting Engineers in connection with the electrical equipment as well as engineers for the construction and starting of the apparatus for acceptance at Panama.

Jose F. de Navarro, who died on February 3, was at one time one of the proprietors of the Ingersoll Rock Drill Co., a predecessor of the Ingersoll-Rand Co., New York. He also promoted the Metropolitan Railway, the first elevated railway built in New York City. He was born in Spain in 1823 and graduated from the Spanish Naval Academy when he was 15 years old. He then went to Cuba and was an instructor in mathematics and astronomy at Havana. He came to the United States when he was 19 years old and taught languages in Philadelphia. In 1844 he started a mercantile business in Cuba, but soon returned to this country and went into business in New York City. He built the Navarro apartments on Fifty-ninth street south of Central Park, which were the first of the high-class modern apartments. He was a director of the Equitable Life Assurance Society and of the Atlas Portland Cement Co., New York.

C. G. Young, heretofore Construction Manager of J. G. White & Co., New York, will open an office as a consulting engineer at 60 Wall street, New York. Mr. Young graduated from Haverling Academy in 1885. In 1886 and 1887 he completed a shop course in the plants of the Schuyler Electric & Manufacturing Co., Hartford, Conn., doing foundry, machine tool, dynamo and lamp work. In 1888 he was made General Superintendent of the Mount Morris Electric Lighting Co., New York. During his four years with this company he built plants and transmission lines for the lighting system of the entire West Side in New York city. He then went to J. G. White & Co. as Construction Superintendent, being also Construction Superintendent of the White-Crosby Co. In 1900 and 1901 he made special investigations, examinations, reports and negotiations for contracts in various parts of the world. He was then made General Manager of Construction for J. G. White & Co., having general supervision over all construction work. In 1906 he was made Construction Manager under the Third Vice-President, where he remained until the present time. Mr. Young starts from the Pacific coast on February 24 for a trip around the world. He is a member of the American Institute of Electrical Engineers, Associate of the American Society of Civil Engineers, and a member of many other technical clubs and associations.



C. G. Young.

TRADE PUBLICATIONS.

Insulation.—A leaflet in the shape of a unique illustration, printed in three colors, shows a messenger carrying a telegram regarding the use of the hair felt for car insulation made by Baeder, Adamson & Co., Philadelphia, Pa.

Oil Burners and Furnaces.—Tate, Jones & Co., Inc., Pittsburgh, Pa., have just issued a series of facsimile letters, bound in filing form, received from several customers, regarding the use of oil burners and furnaces made by this company.

Locomotive Stay-Bolt Iron.—A catalogue illustrating the various tests to which Carter locomotive stay-bolt iron is subject is just being distributed by Christopher Murphy & Co., Chicago. The Carter iron is made by special process in furnaces designed and patented by R. A. Carter, of the Carter Iron Co., Pittsburgh, Pa.

Union Pacific.—Colorado as a winter resort is described in a 20-page pamphlet, issued by the passenger department. The pamphlet is made attractive by views of scenery along the route and by the eloquent way the salubrity of the Colorado climate has been described. Another publication of the Union Pacific, that very uniquely calls attention to its through service to the Pacific coast, is a story entitled "A Los Angeles Limited Romance," by James French Dorrance.

Travel Tours.—This is the title of a quarterly publication issued by the Gillespie-Kinports Co., 1 Madison avenue, New York City. This concern has conducted many summer tours across the continent for several years past. The first number of the quarterly contains descriptive articles concerning the countries to be visited by tours to Mexico, conducted by Mr. Beard; to the Mediterranean, conducted by Mr. Gillespie, and to the Pacific coast, conducted by Mr. Kinports.

Motors, Battery Charging Outfits, Tungsten Lamps, etc.—The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., has just issued a number of standard loose leaf catalogues. Circular No. 1148 covers mercury rectifier battery charging outfits, circular No. 1158 covers electric motor friction brakes, bulletin No. 5533 covers series of incandescent lighting system with Tungsten lamps, and circular No. 1165 is a more artistic presentation of the various uses of Westinghouse a.c. and d.c. electric fans. This catalogue is printed in two colors, contains a large number of half-tone illustrations and is bound in a highly colored cover. Folder No. 4122 describes the electric suction sweeper, made by the Electric Suction Sweeper Co., Canton, Ohio.

Bolt, Nut and Rivet Machinery; Upsetting and Forging Machines and Wire Nail Machinery.—The National Machinery Co., Tiffin, Ohio, has just issued a 200-page catalogue, 8½ in. x 11 in., covering the machinery which it manufactures. The half-tone illustrations and line drawings accompanying the descriptive matter are of sufficient size and excellence to show the details of the machinery to good advantage. The various designs and sizes of the machinery described include the National wedge grip bolt and rivet headers, hammer headers, wedge grip continuous motion rivet headers; heading, upsetting and forging machines, bolt pointing machines; single, double and triple bolt cutters, with attachments; die sharpening machines, forged and pressed nut machines, nut burring and facing machines, nut tappers, washer machines, vertical and alligator shears and wire nail machines. Several tables relating to the bolt business are given in the back of the publication.

Supply Trade Business Conditions.

The following extracts are from letters received within the last two weeks from the concerns named:

National Paint Works, New York.—Business for February promises to be at least double what it was for last February, as we have already reached in actual shipments the amount shipped for the entire month of February, 1908; most of this increased business has come from railways. We are operating to our full maximum capacity and have lately added six new mills to our factory equipment.

Wm. J. Oliver Manufacturing Co., Knoxville, Tenn.—Our plant is now running to a maximum capacity, and the number of employees on our pay-roll would exceed four hundred.

Dodge & Day, Philadelphia, Pa.—We have a number of commissions under way at this time which are in their preliminary stage upon which investigations are being made. In addition to this, we have completed work of this character on a number of good sized propositions which are awaiting the final touches in connection with the financial end. There has been no tendency in the form of a boom in business, but we feel encouraged by a general tendency towards resumption.

Union Malleable Iron Co., East Moline, Ill.—We are very busy at the present time, which is natural, as we depend on the implement manufacturers for a large part of our work.

The Long & Allstatter Co., Hamilton, Ohio.—We are running about one-half our normal capacity, and we have received a reasonable number of orders since the first of the year, which leads us to believe there is a decided improvement in the business outlook.

S. Flory Manufacturing Co., Bangor, Pa.—Within the last two months business in our works has improved very much. We are working full time, having re-employed all the men who had been laid off for a short time during the very great depression since last September. The general outlook for business for this year is very good and have now orders on hand to keep our works going for quite a while.

Jefferson Union Co., Lexington, Mass.—We experienced a notable improvement in business beginning last September which has continued up to the present time, and in October we began running our plant of about 50 employees on full time, having previously been on a four-day basis. While the past two or three weeks' business has been a little quiet, we attribute it to the inventory period, and indications, we believe, are favorable to a steady increase of business from now on. We have taken advantage of the depreciation in business to make extensions to our plant and get ourselves fully equipped.

Indiana Foundry Co., Indiana, Pa.—Business has run along with the past year very satisfactorily to us. In 1908 we gained a little over 20 per cent. in our foundry output over 1907, and have just about completed a 50 per cent. addition to our foundry.

Ajax Manufacturing Co., Cleveland, Ohio.—Inquiries during the past month or two have been very frequent, and look very encouraging. While the number of orders secured during the past few weeks are considerably more than the latter part of December and the first of January, we feel that the number of orders to be placed in the next two or three months will be considerably more still in proportion. The outlook for increased business seems very encouraging to us.

Heine Safety Boiler Co., St. Louis, Mo.—While our shops are not operating up to capacity, we felt sufficiently sure of the future to begin last fall the construction of a new shop, taking advantage of the slack building situation. Trade will unquestionably improve in the near future.

The Charles Parker Co., Meriden, Conn.—Closely following upon the Presidential election, we noticed quite a little spurt in business, but the same has largely fallen off for some little time. We are pleased to note, however, that for the past week there seems to have been quite an increase in the numbr of orders covering our line of vises. It is quite an index to the state of trade when the vise business commences to get back to its normal condition, as it shows that either old factories are fitting up for business in looking over their old tool equipment, or new factories are being opened up. We regret to say that at the present time we do not seem to be receiving a very large amount of business from the railway trade direct, but possibly this may come through some of the jobbing houses who are handling our line. We are now running about 70 per cent. of the number of employees and the number of plants the same as in our normal business. We have recently increased our hours of running per week but have not materially increased the number of employees.

Booth Water Softener.

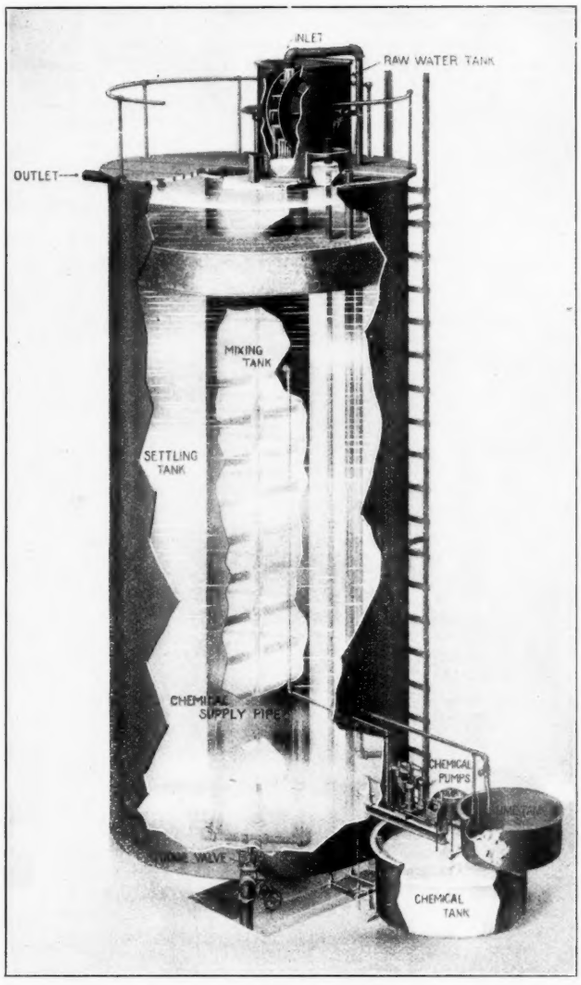
The advantages claimed for the water softeners made by the L. M. Booth Co., New York, include: Compactness and simplicity of construction, convenience of operation, uniform supply of reagents in proper proportions, thorough agitation and efficient sedimentation. The style illustrated herewith is the Type F softener.

The chemicals for treatment, usually quicklime and soda ash, are prepared at ground level. Sufficient lime to last twelve hours is slaked in the lime tank and discharged through a screen into the chemical tank. The pieces of unburned lime, stones, etc., are caught on the screen and disposed of as convenient. The soda ash is thrown directly into the chemical tank, where it is mixed by the action of the agitators with the lime and the proper quantity of water and thus made up to correct strength. Thorough agitation in the chemical tank is necessary to keep the lime suspended in the mixture. In this tank, the paddles work through the entire volume of the chemical tank and have a reciprocating motion. From the chemical tank the chemicals are automatically measured and fed to the water by apparatus which will be described later.

The raw water enters the softener through the inlet pipe, and is discharged on the overshot water wheel located in the raw water tank at the top of the softener. The water wheel furnishes the power required for operating the paddles in the mixing tank, as well as that required to operate the chemical pumps and agitators in the chemical tank. The latter being at ground level, the power is transmitted to them from the water wheel shaft by a link and lever. After passing over the water wheel, the water flows through the raw water weir and chute into the top of the mixing tank, where it meets the chemicals which have been delivered from the measuring device and lifted through the chemical supply pipe. While passing slowly down through the mixing tank, the water and chemicals are thoroughly stirred together by the paddles shown. This insures uniform and complete softening, as every particle of water is brought into intimate contact with the chemicals, and also prevents waste of chem-

icals, as these cannot escape being dissolved and used. The time required for the water to pass through the mixing tank is sufficient for the chemical action; also to thoroughly coagulate the precipitate and prepare it for sedimentation. After leaving the mixing tank at the bottom, the water flows steadily upward in the settling tank, while depositing the precipitate. The water flows through the wood filter to the outlet thoroughly softened, pure and ready for use. The precipitate deposited in the bottom of the settling tank is disposed of each day by opening the sludge valve for a few seconds.

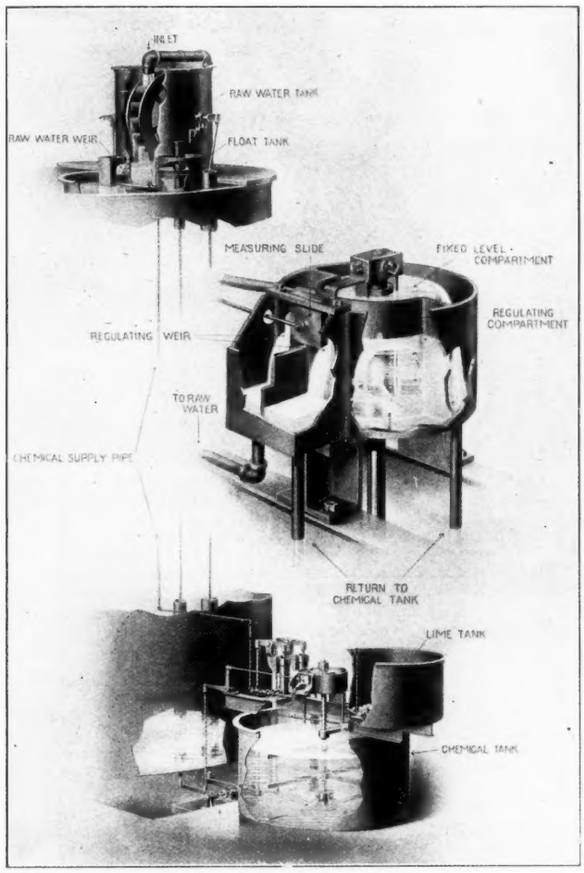
The supply of chemicals is regulated in proportion to the amount of water entering the softener as follows: A uniform stream of chemical solution flows over the chemical regulating weir. A measuring slide, moving along the crest of this weir, divides the flowing solution into two parts, one of which is delivered to the raw water while the other part drops back into the chemical tank. The position of the measuring slide determines the amount of chemicals fed to the water; the measuring slide itself is governed by a float in the float tank, the rise and fall of which is in direct proportion to the amount of water flowing into the softener over the raw water weir. As shown in the illustration the softener is working at half capacity. If a greater amount of raw water enters the softener, the measuring slide will be moved over to the right and cause a proportionately greater amount of chemical solution to be fed to the water. If the inflow of raw water lessens or stops, the measuring slide will proportionately



Booth Water Softener.

move to the left, and partly or entirely cut off the chemical supply. After the chemical solution has become correctly measured off, as described, it flows from the regulating weir to a pump, and is lifted through the chemical supply pipe to meet the raw water in the top of the mixing tank. The flow of chemicals over the regulating weir referred to above is maintained uniform by delivering into the regulating compartment a uniform amount of chemical solution through an orifice in the side of the inner or fixed level compartment. This orifice always being under the same head, the amount of flow through it is unvarying. The fixed level in the inner compartment results because the pump serving it always delivers an excess of chemicals; the excess is allowed to overflow back to the chemical tank. It will thus be seen that the proportioning is all done at the regulating weir, the other parts merely serving to deliver the chemical supply to the weir to be measured, and, after it is correctly measured off, to lift it to be mixed with the raw water. The chemical solution in the regulating apparatus is kept constantly agitated by paddles mounted on an extension of the shaft that serves the chemical tank.

Enough chemicals are usually put into the tank to supply it for 12 to 14 hours. A scale in the chemical tank shows levels to which it should be filled to last for different periods, so the tending of the



Details of Booth Softener.

softener is quite simple. One of the most interesting recent installments of Booth water softeners is one of 10,000,000 gals. daily capacity, put in last year to purify the city water supply of McKeesport, Pa.

Porter Locomotives for Panama.

One of the problems in connection with the Panama Canal is the immense amount of heavy masonry and concrete work for the large locks and dams required. No stone of suitable character was found along the line of the canal, so the Government has opened big quarries at Porto Bello, not far from Colon. This place was originally intended for the Atlantic terminus of the canal by the French. It has a deep and land-locked harbor, on one side of which is a very old Spanish town, which was practically destroyed in the buccaneering times and is now in ruins, the few inhabitants living in primitive style in shacks. Across the bay from the old town is the new United States settlement, and the quarries. The wharf facilities are good, and the rock will be handled from the quarries—which are situated well up the side of a hill—by a system of railway tracks, with three or four switchbacks, requiring grades of 3 per cent. and curves as sharp as 30 degrees. The rock is taken from the quarries by locomotives and cars, the gage of track being 42 in, and is hauled to a point where it can be dumped down a chute to the crushers. From the crushers it goes down another chute to the loading bins on the dock at deep water, whence it is loaded into barges, taken along the coast to Colon, and thence up the canal to the points where the rock is to be used. This railway is to be operated by ten locomotives which the Government bought from the H. K. Porter Co., Pittsburgh, Pa. They are six-wheel connected, saddle-tank locomotives, cylinders 15 in. by 20 in., driving wheels 40 in. in diameter, boiler pressure 170 lbs., weight in running order about 80,000 lbs., and tractive force 16,260 lbs., giving a factor of adhesion of 4.9. These locomotives are well adapted to the service, having very large boilers and fireboxes, and are good steamers, hauling heavy trains up

the grades. The locomotives are equipped with air-brakes, M. C. B. automatic couplers, balanced slide valves, metallic packing and cross-heads of two-bar type. The saddle-tank capacity is 1,050 gallons, and fuel capacity 3,000 lbs. coal. The order for these locomotives was placed September 2, 1908, with the promise that deliveries at Colon would begin by November 5, and end November 18, 1908. The locomotives were all delivered ahead of time.

Just before the arrival of the locomotives at Porto Bello there was



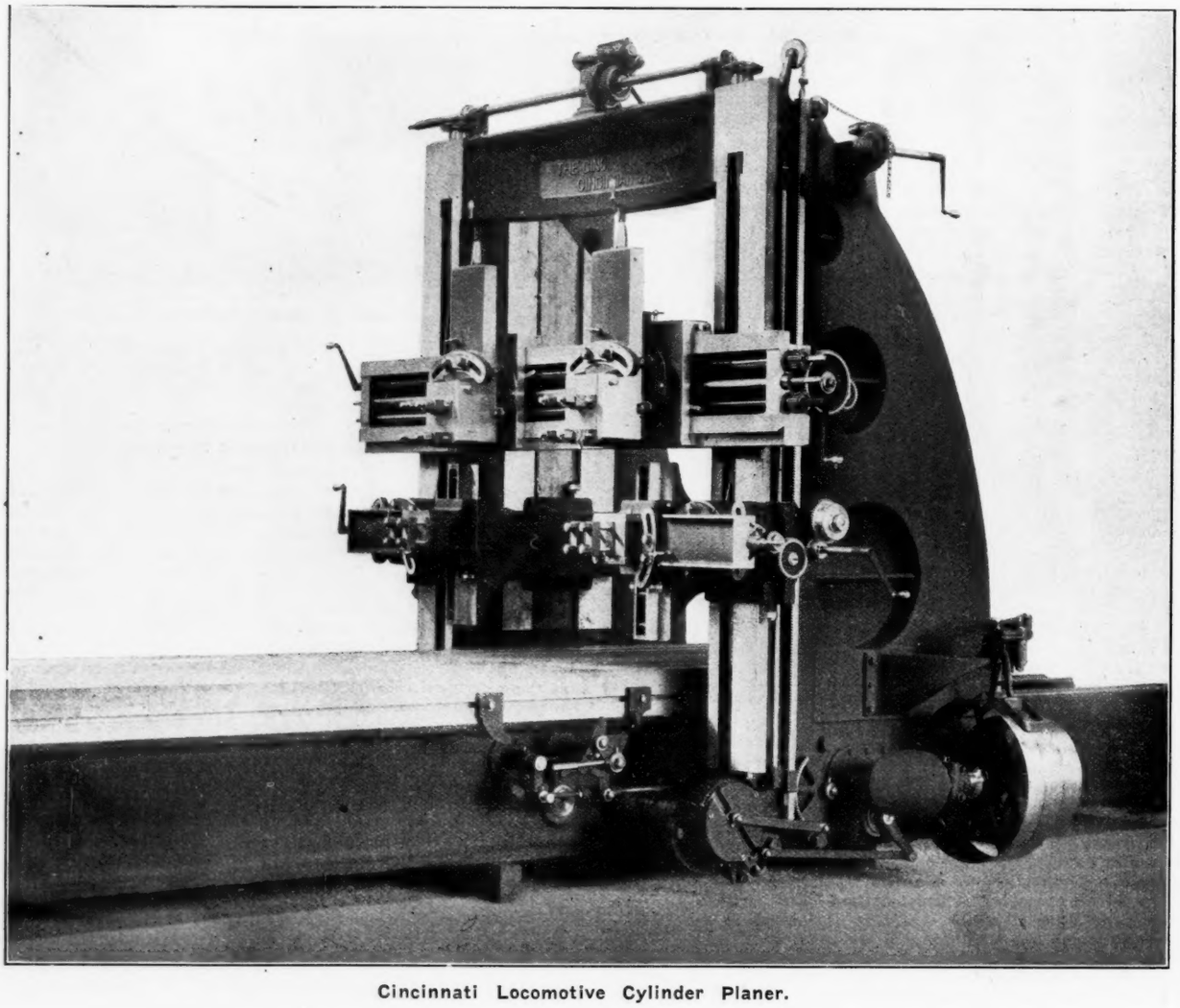
Porter Locomotives for Panama.

an unusually heavy tropical storm, with tremendous rainfall, washing away a good deal of the track and doing other damage, and increasing the difficulty of setting up the work. The Porter system of construction greatly facilitated the erection of these locomotives on arrival, and they went together with only a limited number of machinists available, and under various adverse conditions, at the rate of one engine a week.

The illustration shows the first three locomotives after they had been set up on arrival at Porto Bello. The quarries are on the far side of the hill in the background, and a hydraulic pipe-line is visible running up the hill for washing off the soil and rubbish from the rack ledges.

Cincinnati Locomotive Cylinder Planer.

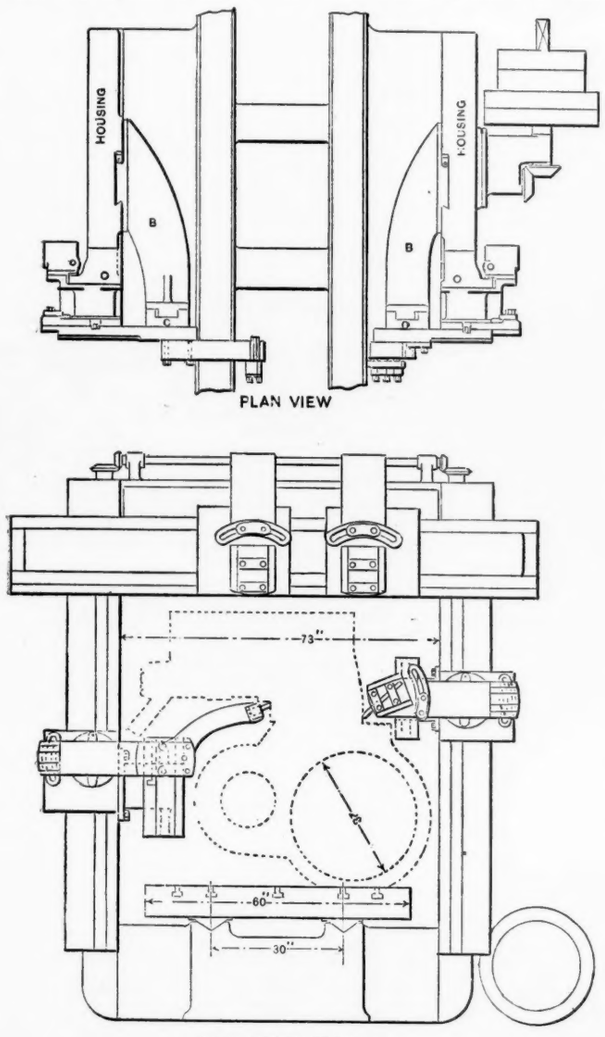
The illustrations herewith show a 72-in. x 72-in. x 18-ft. planer built for machining locomotive cylinders and especially those with piston valves. The machine itself is a regular planer arranged for parallel drive, excepting the side heads, which are a radical departure from the usual practice. The housings are machined on the inside with a dovetail toward the front and square on the opposite, into which fits a bracket B, shown in the drawing. This bracket is counterbalanced with chain and weight; a chain was used in place of tiller rope, so that a crank could be applied to the sprocket wheel for raising and lowering the bracket to suit the various cylinders. This bracket is secured to the housing by tightening the taper gib on the straight side, which forces the bracket against the dovetail and draws it against the bearing. The front end of the bracket is made rectangular in section, and is machined and scraped parallel with the housing. On to this is fitted a shoe C, which has a dovetail on the opposite side that fits the cross slide of the side head. After the slide is run onto this shoe, it is adjusted on the bracket by the two taper gibs. After this is done the shoe is a part of the side head to that when the side head is moved up or down it carries with it the shoe, which slides on the bracket B. When it is necessary to reach out, say 24 in., from the housing edge with the tool and the bracket extending out about 18 in., the tool is supported more rigidly than if the piece was placed on the edge of the table very close on the housing, because of the additional support given by the second bearing on the housing. The bracket B was made of a length to clear the projections on all sizes and makes of cylinders and yet have enough bearing so that the shoe C would never extend over the bearing on the bracket.



Cincinnati Locomotive Cylinder Planer.

Whenever the machine is to be used for other purposes than cylinders, the slide can be run back in the usual way on the side head, and the bracket raised out of the way. Then the machine has the usual full capacity for ordinary planing.

The drawing shows one of the most difficult cylinders to plane



Views Showing Auxiliary Supports for Side Heads and Typical Work in Planer.

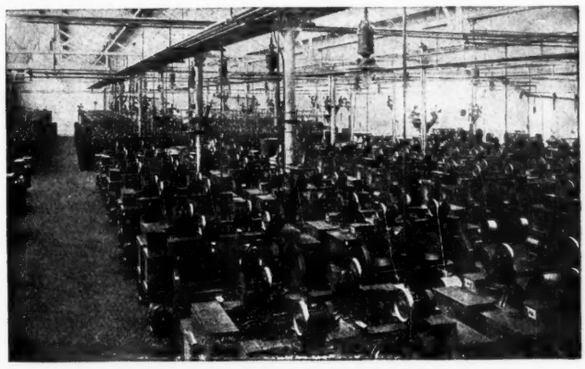
in place on the planer table, and illustrates very plainly the advantage of supporting the tool where it is necessary to reach out so far to get at the work.

Manufacture of Lead Covered Cable.

In order to have sufficient strength to withstand even ordinary weather conditions, copper wire for telephone service must be of such size as to make it extremely expensive. Iron wire is not desirable for many localities, such as in the gas laden atmosphere of cities or in the salty air of coast sections, because of its susceptibility to chemical action. Aside from the great expense of maintenance, such poor service is received that some sort of wire protection is imperative. For this protection the dry core type of lead covered cable is commonly used. This cable may be strung on poles in the usual way or it may be laid underground. The former method is chiefly employed in towns and in the smaller cities, but in larger cities the underground method is preferable as poles are unsightly and take up valuable space.

The cable manufacturing plant of the Western Electric Co., Chicago, is at Hawthorne, Ill. This plant has a capacity of turning out 20,000,000 conductor feet or 3,488 conductor miles of telephone cable per day. In this immense output of cable over 24 tons of copper and nearly 73 tons of lead are used. By the purchase of raw materials in great quantities, the lowest prices and the best quality are secured. The dry core type of lead covered cable, having the conductors loosely insulated with paper—has almost entirely superseded the saturated core type, which has its conductors separately insulated and all impregnated with an insulating compound, because of its lower cost and better transmitting qualities. It has also been found that cable having its conductors insulated by a single wrapping of paper gives the most satisfactory results in all kinds of aerial and underground cable.

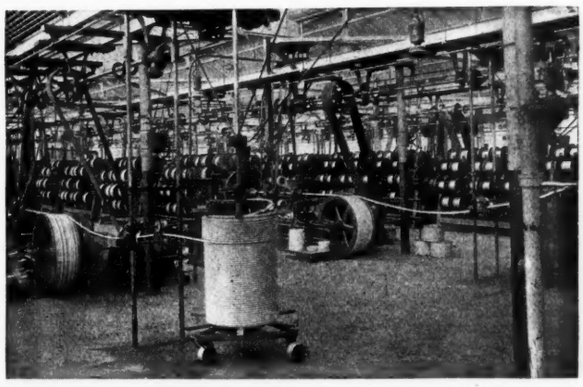
The raw materials used in the manufacture of Western Electric cable are delivered to the storerooms in carload lots; copper wire in the form of coils, lead in pigs and insulating paper in rolls. The insulating paper is of a special make and is manufactued expressly for the Western Electric Co. Each copper wire is separately insulated by a machine especially designed for the purpose. A roll of insulating paper is fastened to a head which is made to revolve. The copper wire is uncoiled from a stand on the floor. It is led up over a pulley, through the center of the head and around a capstan. The revolving head winds the paper spirally around the wire. The insulated wire continuing on is then wound on a spool placed directly under the machine. Next, the insulated wires are twisted in pairs. The insulating and



Twisting and Insulating Machines.

twisting machines are individually operated by Western Electric motors.

The twisted pairs of conductors are then sent through the stranding machines and formed into cores which are made in sizes from 5 to 600 pairs. This machine is divided into sections called drums. To these sections or drums are fastened the spools upon which the twisted pairs are wound. As the drums revolve these pairs are unwound from the spools and passing through a perforated iron disk attached to the drum and revolving with it, are stranded into the core in layers, each layer running diagonally across the one immediately within it. A sufficient number of spools are used on each drum to form a complete layer of core and as many drums can be used as is desired, depnding upon the number of pairs on the cable which is to be stranded. At each section is a button switch which enables the whole machine to be instantly stopped from almost any point. During



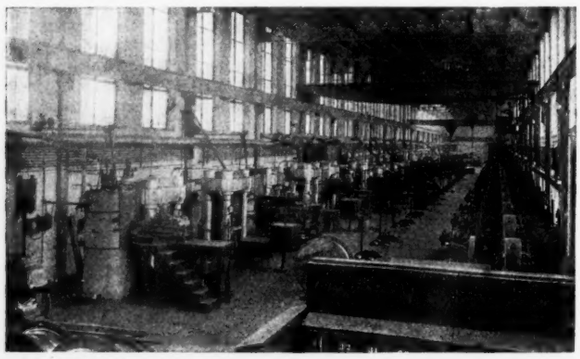
Stranding Machines, in Background, and Cable Being Wound on Reel Ready for Drying, in Foreground.

this process the stranded core is covered with a close spiral wrapping of two ribbons of insulating paper each one overlapping the other. This wrapping is very strong, free from chemicals, and capable of withstanding intense heat.

After the core is formed, a test is given for the continuity of every wire in the cable, also a test for short-circuits and grounds. It is then wound automatically on an iron truck and thoroughly dried in an oven, usually from 24 to 48 hours.

The last process is that of encasing the core in its lead sheath, which merely serves to protect the conductors from mechanical injury and moisture. The lead of which this sheath is composed contains a small quantity of tin which serves to give it the greatest resisting qualities with the least possible weight. In the case of submarine cable the conductors are still further protected by a covering over the lead sheath consisting of jute, galvanized iron armor wire, and hemp treated with preservatives and waterproof compounds. By means of

the lead presses and hydraulic pumps the lead, being heated just enough to become plastic, is forced under great pressure into a die-block through the middle of which the core is drawn, thus encasing the core in a seamless sheath of lead. A small portion of the sheath is forced through the die-block before the first end of the core appears, and this is bent in and closed up in order to keep out the air. The last end is sealed in a similar manner. As the lead sheathed cable comes

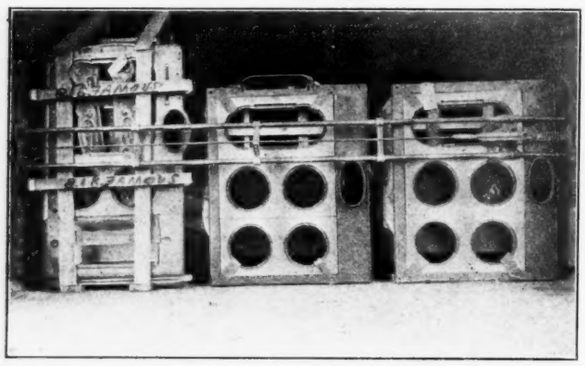


Lead Presses, at Left, and Hydraulic Pumps for Presses, at Right.

out of the presses it passes over a trough of mirrors, thus enabling the workman to inspect the entire cable and to detect any possible flaws in the sheath. Finally the finished cable is reeled and lagged and is then ready for shipment. After every process in the course of construction the cables are subjected to the most exacting tests.

Taylor Package Brace.

The accompanying illustrations show a device for use with less-than-carload lots of eggs, butter, dressed poultry in barrels and other package freight which must be braced in the car to prevent damage from the handling of trains in transit and in switching movements. Such bracing is usually done with 2-in. x 4-in. timbers, but this takes time and is more or less expensive, the timbers usually



Taylor Package Brace Holding Stoves.

being lost after using once, and the nails damage the inside of the car, and also the insulation if it is a refrigerator car. The brace here shown has been tried on the Illinois Central. It is made of gas pipe, cross braced and trussed. The end pieces are malleable iron, with short speers to hold in the wood of the car side. The



Taylor Package Brace Holding Candy Buckets.

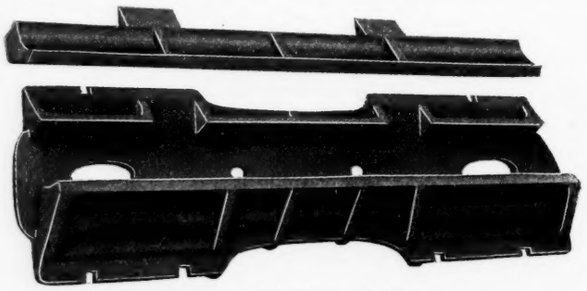
ratchet device is arranged to permit very close adjustment in placing the brace. While heavier than a wooden brace, one man can handle it, and put it in position easily and quickly.

The committee on mechanical devices of the Railroad Refrigerator Service Association recently made an inspection of this brace and reported favorably on it to the association. One test reported by this committee was of a shipment over the Illinois Central to Chicago of 54 tubs of butter starting from Albert Lea, Minn., and picking up cargo en route, the last lot being taken at Janesville, Iowa. When the car was opened at Chicago the butter tubs, which were in one end of the car, four tiers high and held by two of the braces, were intact and in excellent condition. The braces also were in good condition. The length of this trip was 419 miles.

The inventor of the brace is William I. Taylor, a freight conductor on the Illinois Central. Further information concerning it can be obtained from E. F. McPike, Secretary of the Railroad Refrigerator Service Association, No. 1 Park Row, Chicago. Preparations are being made to put the device on the market.

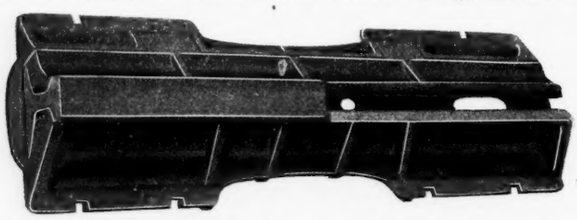
Williams Boltless Rail Joint.

The accompanying illustrations show a two-piece boltless rail joint invented by Willis T. Williams, of Kirkland, Ariz. The joint was first put in trial service on the Pecos River line of the Santa Fe at Roswell, N. Mex., where it remained for 11 months. We understand that when removed at the end of that time it showed neither corrosion nor bright spots indicating wear. Six of these joints have been in ser-



Parts of Williams Joint.

vice for nine months on the Fort Wayne division of the Pennsylvania Lines West, six for six months in the yards of the St. Paul Union Depot Co., and six for four months on the Wisconsin division of the Chicago & North Western. The accompanying view of the joints in track was taken in the North Western yards in Chicago and the line



Assembled Joint.

on which they are installed carries the heavy North Shore suburban traffic of the road, as well as the through traffic for this division.

The joints are made of malleable iron and have on the bottom a series of transverse ribs for strength, the outer ones of which come against the tie and prevent longitudinal movement. To prevent rail creeping, there is a round hole through the joint midway of the outer side, in which a 1-in. round bolt is inserted, the rail flanges being cut



Williams Boltless Rail Joints in North Western Track.

away at the adjacent corners the slight amount necessary to permit the insertion of the bolt. The joints are 26 in. long, and weigh the same as a yard of the rail to which applied; the joint for an 80-lb. rail, for example, weighing 80 lbs. The Williams Boltless Rail Joint Manufacturing Co. has been formed, headquarters, Great Northern Bldg., Chicago.